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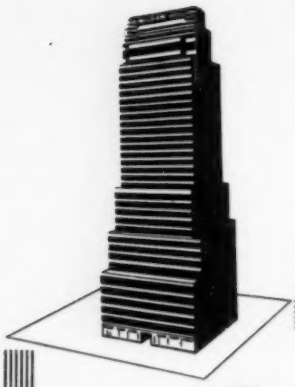

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OFFICE OF THE ASSOCIATION OF AMERICAN MEDICAL COLLEGES

2530 Ridge Avenue, Evanston, Illinois, DAvis 8-9505

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INFORMATION FOR CONTRIBUTORS

The Journal of Medical Education serves as an international medium for the exchange of ideas in medical education, as well as a means of communicating the policies, programs, and problems of the Association. The Editorial Board welcomes the submission of manuscripts concerned with the broad field of medical education; this includes preparation for medical education; the medical school experience; intern and resident education; graduate and postgraduate medical education. The Editorial Board recognizes that medical education includes the activities of faculty, students, administrators, and those of the practicing profession who also teach and learn. Thus, it invites communications from any of these sources.

Manuscripts should be submitted in duplicate. All manuscripts are reviewed by the Editorial Board before acceptance for publication. All copy, including footnotes, tables, and legends, should be typed double-spaced. Each diagram or graph or photograph should have a brief legend. Each table should be typed on a separate sheet of paper. References should refer to published material only, must be submitted in alphabetical order, and should include, in order: author, title, journal abbreviation (*Quarterly Cumulative Index Medicus* form), volume number, page, and year; book references should also include editors, edition, publisher, and place of publication.

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Medical Education Forum includes editorials, letters, comments, criticisms, and excerpts from important addresses.

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Items of Current Interest: Audio-visual news and notices from national and federal agencies appear in this section.

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Address all correspondence regarding manuscripts, editorials, and letters to the Editor to the Editorial Office, University Hospitals, University of Wisconsin, Madison 6, Wisconsin.

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Calendar of Meetings

ASSOCIATION OF AMERICAN MEDICAL COLLEGES

71st Annual Meeting, October 31–Nov. 2, 1960
Diplomat Hotel, Hollywood, Fla.

1960

JANUARY

AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS, The Palmer House, Chicago, Jan. 23–28. Mr. John K. Hart, 116 S. Michigan, Chicago 3, Executive Secretary.

AMERICAN COLLEGE OF SURGEONS, Sectional Meeting, the Brown Hotel, Louisville, Ky., Jan. 21–23. For information write: Dr. H. P. Saunders, 40 E. Erie St., Chicago 11.

FEBRUARY

AMERICAN ACADEMY OF OCCUPATIONAL MEDICINE, Williamsburg Inn, Williamsburg, Va., Feb. 10–12. Capt. Lloyd B. Shone, Bureau of Medicine and Surgery, Navy Dept., Washington 25, D.C., Secretary.

AMERICAN COLLEGE OF ALLERGISTS, INC., Americana Hotel, Bal Harbour, Miami Beach, Fla., Feb. 28–Mar. 5. Mr. Eloi Bauers, 2160 Rand Tower, Minneapolis 2, Executive Vice-President.

AMERICAN COLLEGE OF RADIOLOGY, Roosevelt Hotel, New Orleans, Feb. 3–6. Mr. William C. Stronach, 20 N. Wacker Dr., Chicago 6, Executive Director.

AMERICAN COLLEGE OF SURGEONS, Sectional Meeting for Surgeons and Nurses, Statler Hilton, Boston, Feb. 29–Mar. 3. For information write: Dr. H. P. Saunders, 40 E. Erie St., Chicago 11.

AMERICAN ORTHOPSYCHIATRIC ASSOCIATION, INC., Sherman Hotel, Chicago, Feb. 25–27. Marion F. Langer, Ph.D., 1790 Broadway, New York 19, Executive Secretary.

CLINICAL CONGRESS OF ABDOMINAL SURGEONS, Deauville Hotel, Miami Beach, Fla., Feb. 1–5. For information write: Clinical Congress of Abdominal Surgeons, 633 Main St., Melrose 76, Mass.

Congress on Medical Education and Licensure, Palmer House, Chicago, Feb. 7–9. For information write: Council on Medical Education and Hospitals, American Medical Association, 535 N. Dearborn St., Chicago 10.

SOCIETY OF UNIVERSITY SURGEONS, Minneapolis, Feb. 11–13. Dr. Ben Eiseman, 4200 E. Ninth Ave., Denver 20, Secretary.

SYMPOSIUM ON FUNDAMENTAL CANCER RESEARCH (14th), University of Texas, Houston, Feb. 25–27. For information write: University of Texas M. D. Anderson Hospital & Tumor Institute, Houston 25, Texas.

MARCH

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION, Deauville Hotel, Miami Beach, Fla., Mar. 15–16. Dr. F. Johnson Putney, 1712 Locust St., Philadelphia 3, Secretary.

AMERICAN ACADEMY OF FORENSIC SCIENCES, Drake Hotel, Chicago, Mar. 3–5. Dr. W. J. R. Camp, 1853 W. Polk St., Chicago 12, Secretary-Treasurer.

AMERICAN ACADEMY OF GENERAL PRACTICE, Philadelphia, Mar. 19–24. Mr. Mac F. Cahal, Volker Blvd., at Brookside, Kansas City 12, Mo., Executive Director.

AMERICAN ASSOCIATION FOR THE HISTORY OF MEDICINE, INC., Charleston, S.C., Mar. 24–26. John B. Blake, Ph.D., c/o Smithsonian Institution, Washington 25, D.C., Secretary.

AMERICAN COLLEGE OF SURGEONS, Sectional Meeting, The Broadmoor, Colorado Springs, Colo., Mar. 21–23. For information write: Dr. H. P. Saunders, 40 E. Erie St., Chicago 11.

AMERICAN COLLEGE OF SURGEONS, Sectional Meeting, Sheraton-Portland Hotel, Portland, Ore., Mar. 28–30. For information write: Dr. H. P. Saunders, 40 E. Erie St., Chicago 11.

AMERICAN GASTROENTEROLOGICAL ASSOCIATION, Roosevelt Hotel, New Orleans, Mar. 31–Apr. 2. Dr. Wade Volwiler, Dept. of Med., Univ. of Washington, Seattle, Secretary.

AMERICAN GASTROSCOPIC SOCIETY, Roosevelt Hotel, New Orleans, Mar. 30. Dr. Arthur M. Olsen, Mayo Clinic, Rochester, Minn., Secretary-Treasurer.

AMERICAN LARYNGOLOGICAL ASSOCIATION, Deauville Hotel, Miami Beach, Fla., Mar. 18–19. Dr. Lyman Richards, Massachusetts Institute of Technology, Cambridge 39, Mass., Secretary.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC., Deauville Hotel, Miami Beach, Fla., Mar. 15–17. Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N.Y., Secretary.

AMERICAN OTOLOGICAL SOCIETY, Deauville Hotel, Miami Beach, Fla., Mar. 13–14. Dr. Lawrence R. Boies, University Hospital, Minneapolis 14, Minn., Executive Secretary-Treasurer.

AMERICAN OTORHINOLOGIC SOCIETY FOR PLASTIC SURGERY, INC., Deauville Hotel, Miami Beach, Fla., Mar. 6–13. Dr. Joseph G. Gilbert, 75 Barberry Lane, Roslyn Heights, N.Y., Secretary.

AMERICAN PSYCHOSOMATIC SOCIETY, Sheraton-Mount Royal Hotel, Montreal, Mar. 26–27. Miss Joan K. Erpf, 265 Nassau Rd., Roosevelt, N.Y., Executive Assistant.

AMERICAN RADIUM SOCIETY, Caribe Hilton Hotel, San Juan, Puerto Rico, Mar. 17–19. Dr. Robert L. Brown, Robert Winship Clinic, Emory University, Atlanta 22, Ga., Secretary.

NATIONAL HEALTH COUNCIL, NATIONAL HEALTH FORUM, Miami, Fla., Mar. 13–18. Mr. Philip E. Ryan, 1790 Broadway, New York 19, Executive Director.

NATIONAL MULTIPLE SCLEROSIS SOCIETY, New York City, Mar. 8. Mr. Donald Vail, 257 Fourth Ave., New York 10, Secretary.

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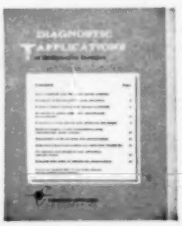


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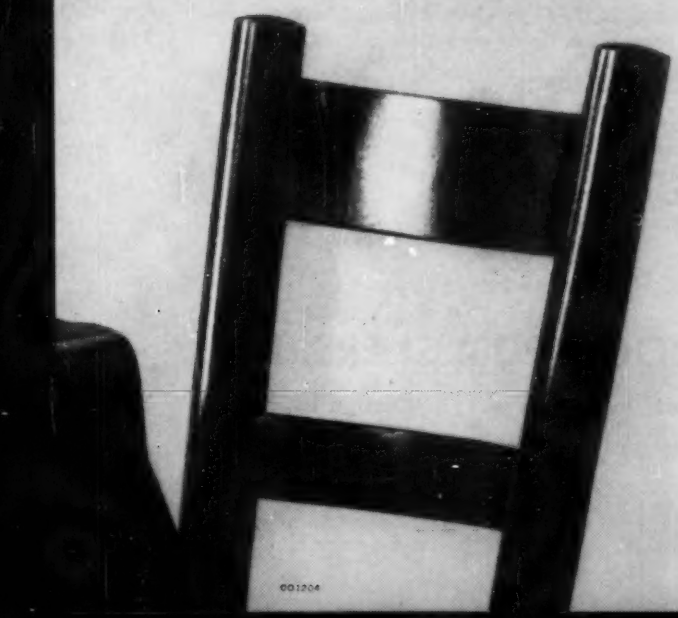

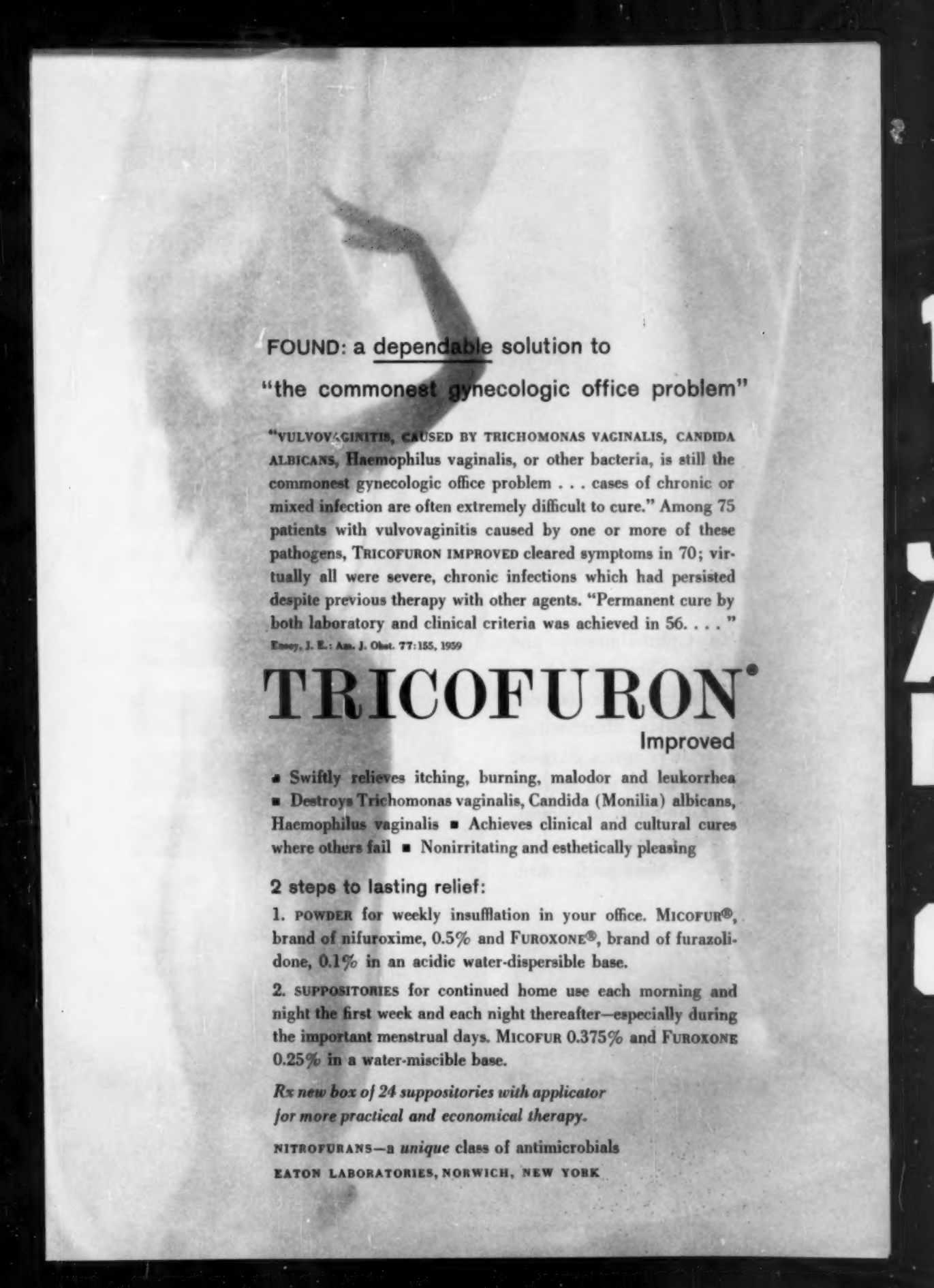

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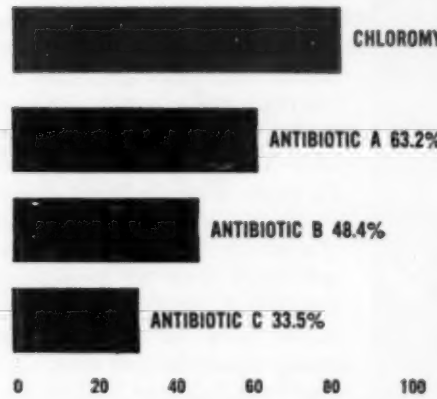

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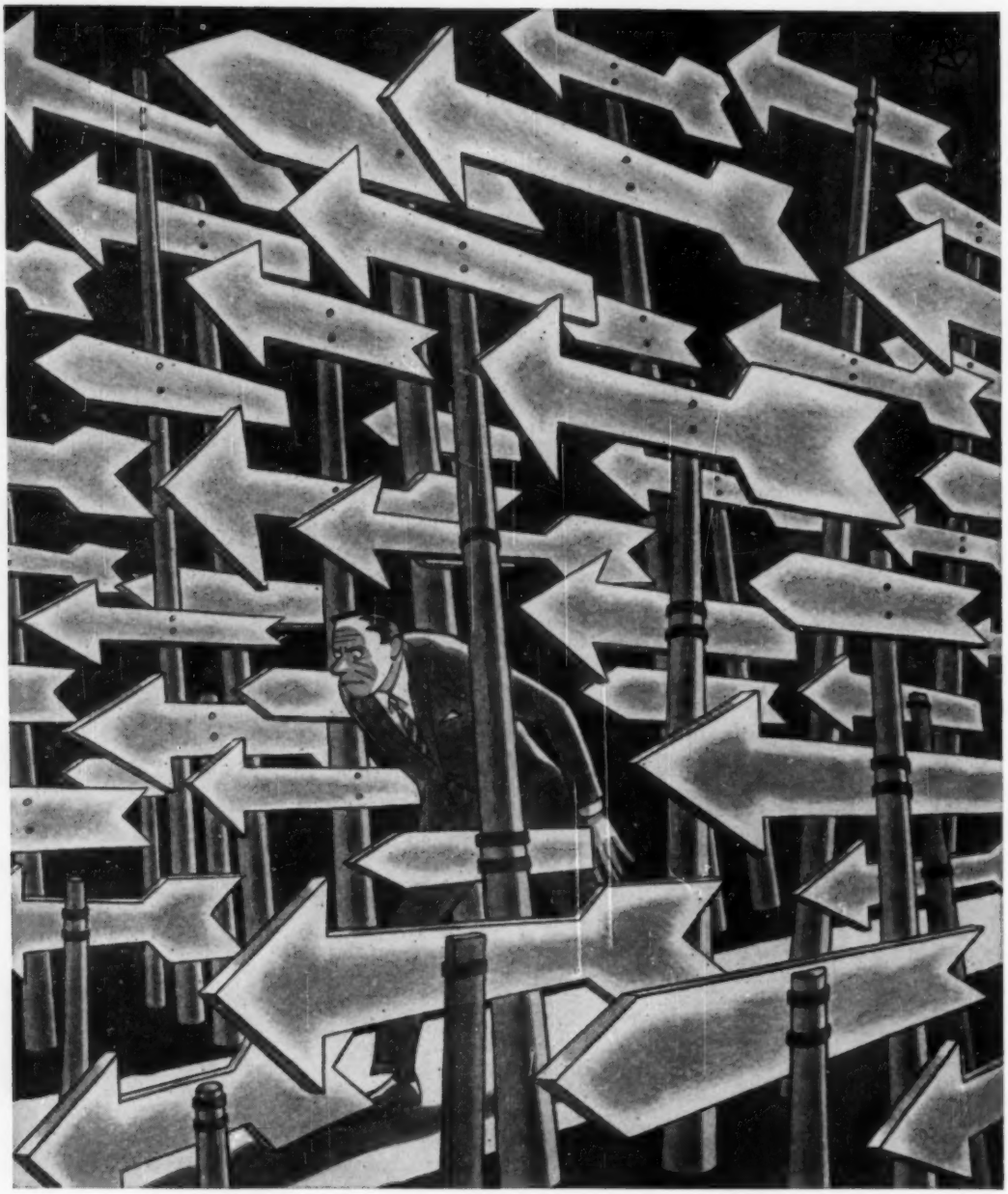

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LABORATORY ANIMALS: THEIR CARE AND THEIR FACILITIES

Foreword

There is growing realization by faculties and administrators of the importance of adequate animal facilities under qualified professional supervision for the educational and research programs of the medical schools. Such facilities not only pay dividends in improving experimental results but also in gaining public support for studies involving animals.

A group of distinguished experts with experience in various aspects of animal care have been invited to prepare articles in their fields of special competence. The result is a group of outstanding papers on the design, construction, and operation of animal facilities which the *Journal* presents in this special issue. The Editor wishes to acknowledge the valuable counsel and assistance which Dr. Bennett Cohen gave in planning the series.

JOHN A. D. COOPER, M.D., PH.D.
Guest Editor

Ethical Considerations in the Use and Care of Laboratory Animals

LESTER R. DRAGSTEDT, M.D., PH.D.*
Department of Surgery, University of Chicago, Chicago, Illinois

The antivivisection movement is primarily opposition to the use of dogs in medical research and teaching. There is little or no objection to the use of other experimental animals. Revulsion at the barbarous cruelties inflicted by man on his fellowmen in the great wars of modern times has led to an idealistic reverence for all life in the minds of many good people. Opponents of the use of dogs in scientific research have been quick to ally themselves with this sentiment, and questions have been raised regarding the moral and ethical right of man to improve his lot at the expense of the comfort and life of lower animals. It is wise and necessary to look at this question again with clear and open eyes.

The benefits that have come to mankind as a direct result of scientific experiments on dogs are now so great and well known that every intelligent layman can be expected to be fully informed. Indeed, high school students have given a very creditable performance in this area in a series of essays on the value of animal experimentation published by the Illinois Society for Medical Research. It should be unnecessary to recall again the disappearance of smallpox, which in the 17th century was as prevalent as measles is today; the disappearance of bubonic plague, cholera, typhoid fever, diphtheria, scarlet fever, typhus, and many other epidemic diseases. All these achievements are a direct result of knowledge obtained from experimental studies on lower animals.

* President, National Society for Medical Research, Professor of Surgery, The University of Chicago.

The Federal Government is appropriating millions of dollars each year to support medical investigation of diseases such as cancer, heart disease, and insanity which still cause enormous suffering and premature loss of life. This expenditure has proved profitable, and already large dividends have resulted in the discovery of surgical methods for the better treatment of congenital and acquired diseases of the heart and arteries, surgical shock, stomach ulcers, and malignant disease. In much of this work the use of dogs condemned to be destroyed in city pounds has been essential. Justification for this lies in the conviction, expressed by Dr. A. J. Carlson, that the life of a man is worth more than the life of a dog.

Mankind has always faced this problem. Early man secured his food and clothing by hunting, and today millions of animals are raised and slaughtered to provide food, clothing, and life-saving drugs. A constant battle is being waged with hordes of insects which threaten man's food supplies. The housewife is scarcely irreverent when she kills spiders, flies, and other vermin each day.

The great intellectual leader, Charles W. Eliot, has well said, "The humanity which would prevent human suffering is a deeper and truer humanity than the humanity which would save pain or death to animals." It must not be overlooked that animals themselves have benefited significantly from this type of medical research. Furthermore, it is probable that the total amount of suffering which animals undergo in experimental laboratories is negligible in compari-

son with that which confronts most of them in the state of nature.

The biologist yields to no one in his reverence for living things. Life to him is the supreme miracle, and he spends his lifetime in contemplation and study of its various phenomena. It is a mistaken notion that in this work he inflicts needless suffering on lower animals. He has always been solicitous about their hygiene and care and, in the early days, did the best he could with funds that were available. Now that better support for all areas of science is available, model animal quarters are being constructed in almost all medical schools and research centers. The development of the Animal Care Panel is but one example of this solicitude for the welfare of the dogs and rabbits used in medical research. The scientist more than anyone else recognizes that his experimental animals must be free of disease if the results of his study are to be accurately interpreted. The shelters and care provided for unclaimed animals are almost always far inferior to those existing in the experimental laboratories. It is evidence of the scientist's reverence for life that he avoids all unnecessary suffering in his work and is dedicated to the search for knowledge that will make the lot of man freer from pain, suffering, and premature death.

The Design of Animal Quarters

W. T. S. THORP, D.V.M.*
College of Veterinary Medicine, University of Minnesota, St. Paul 1, Minnesota

The planning, construction, and operation of an efficient yet adequate animal facility, for any institution, are projects which require careful consideration by all persons concerned. The health and safety to both animals and personnel are important considerations. It would be far simpler if one were designing quarters specifically for a department such as surgery, microbiology, physiology, and the other categories in a medical college or medical research institution. Since few institutions can afford to do this, the problem then becomes one of compromise and adjustment to the needs of various groups, funds available, size of the animal quarters, location and management of the facility.

It is the intent of this discussion to present some of the important considerations and recommendations which may be used in planning animal quarters. It cannot represent all the ideas and types of quarters which are in use, nor is it possible to formulate a design for animal quarters which will meet the requirements of all institutions.

General considerations.—The location of the animal quarters should be given careful consideration, since much depends on this decision. The locale, however, is determined and governed to some extent by the species of animals to be housed. For example, dogs may be more of a problem to adjacent areas than mice. The ideal would be a single-storied structure; however, real estate costs and the desire to have the animal quarters near the research laboratories do not always make this possible. The best location is on the ground level or a properly air-conditioned basement area. Ground level locations may cost more initially; this will, however, be offset by savings in labor, time, and efficiency of operation.

The construction of new animal quarters is preferred to the rehabilitation of an existing building. In those instances where the latter is necessary, the animal quarters should be confined to one floor or adjacent floors. The accepted practice of housing animals in research buildings and hospitals calls for very careful consideration. Important at all times, but especially when animal quarters are part of an over-all building, are odors; handling of refuse, food, and bedding; supplies; insects; the receiving of animals and animal foods; and special facilities to prevent escape of animals. A special entrance for supplies of the animal building is essential.

Under no circumstances should animals, animal foods, and bedding come through a general receiving area. Shipping cages of animals, such as monkeys, should not come through the same receiving area as hospital supplies.

Many, in fact practically all, of our new medical centers are multi-storied buildings; thus, the animal quarters should be confined to one floor. If more than one floor, the elevator transport of materials will take approximately 10 per cent more labor and will require large freight-type elevators if the facility has central cage washing on one floor. Some duplicate feed, bedding, and cage storage will be required on each floor.

It is poor long-range planning to consider only the design of quarters necessary to work with the species predominant at the time.

* Dean, College of Veterinary Medicine.

This is especially true in a research institution, but not so much the case in the control laboratory of a pharmaceutical or biological industry. Medical research programs continually change from year to year. This necessitates the planning of facilities which can be used for either mice, rats, rabbits, and guinea pigs, on the one hand, and for dogs or monkeys, on the other. The intermingling of species in the same room is not good from the standpoint of disease prevention.

The use of a refuse corridor on one side of a bank of animal rooms and a clean corridor on the other is strongly recommended for the small animal rooms (Chart 1). This is especially true if the rooms are used for the production of the small experimental animals or certain infectious disease research.

There is a very definite trend on the part of the better commercial animal producers to provide research workers with specific pathogen-free animals. These are animals started from cesarean section and produced under isolation conditions. They are not to be confused with the completely germ-free animal. As the result of this both the producer and research worker are more aware of disease problems in the small experimental animal. The relation of this trend to animal quarters design is obvious. If experimental animals such as mice are produced under strict disease-control conditions, which permit the control of the infections common to this species, then the facilities where they will ultimately be used should be of the design that can take advantage of this type of animal.

Arrangement and room size.—The size of animal rooms now in use varies a great deal depending upon local circumstances. The type of caging and species housed will determine, to a great extent, room size. In general, the room size should be limited to the animal capacity which can routinely and adequately be cared for by one animal attendant. This is more difficult in the research institution than in animal production facilities. The use of vestibule entrances which include a sink and place to change clothing and footwear will do much to prevent epidemics and intercurrent infections. This is essential to infectious disease research. Animal room size will vary, depending upon the general module of the building unless the entire building is an animal facility.

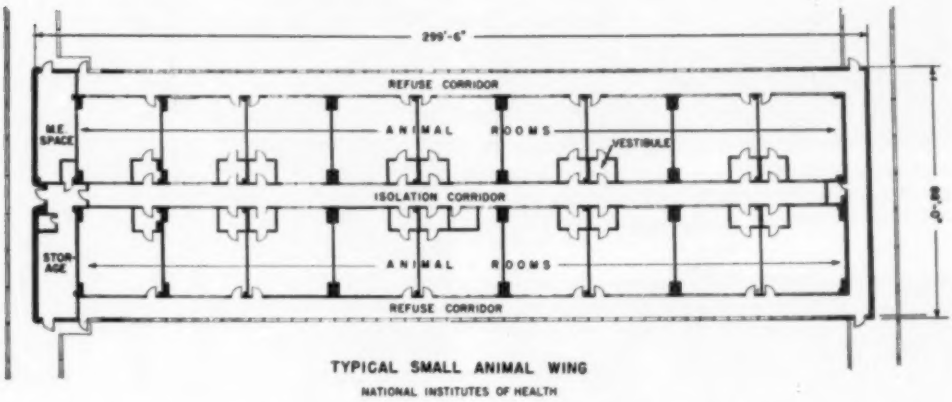

CHART 1.—Illustrates the refuse and isolation on clean corridor concept. Note the vestibules for each room off the clean corridor at the National Institutes of Health.

Estimates were developed at the National Institutes of Health, United States Public Health Service, based on their experiences from 1948 to 1950. They are presented as a guide (Table 1).

There are three main categories of rooms

to be considered for small animals: experimental, production, and quarantine. This does not include dog and monkey rooms. Experimental rooms usually range in size from 240 to 300 square feet. Breeding rooms will range from 200 to 900 square feet but should not exceed the higher limit. Smaller rooms can be used for strains maintained in lesser numbers. It is best to house only one breeding strain per room and in no case more than three. Quarantine rooms for new shipments of animals are essential to minimize the spread of infections which may exist from some incoming animals. This is particularly true with the increased use of "specific pathogen-free" animals. An arrangement should never be made by which it is necessary to pass through one animal room to enter another. Rooms should always open onto a corridor.

A system of locating a large isolation room adjacent to a room made up of several cubicles and work space is worthy of consideration for experimental animals (Chart 2 and Fig. 1). This provides for the isolation of cage racks in glass-enclosed cubicles

TABLE 1

ESTIMATED NET* SQUARE FEET OF EXPERIMENTAL ANIMAL ROOM SPACE

Mice	7	per square foot
Gunea pigs	2	" " "
Rats	5	" " "
Rabbits	1	" two square feet

ESTIMATES FOR THE ANTICIPATED PRODUCTION FROM A BREEDING COLONY

Mice	At rate of 50	per net square foot annually
Guinea pigs	" " " 2	" " " " " "
Rats	" " " 1	" " " " " "
Rabbits	" " " 10	" " " " " "

* Net space does not include corridors, vestibules, storage, etc.

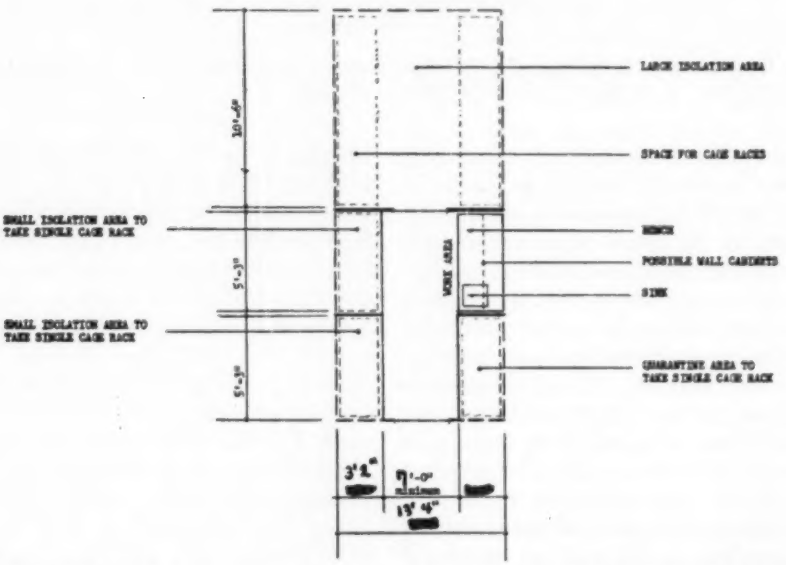

CHART 2.—Sketch of isolation room and isolation cubicles at University of Illinois, Research Laboratories, Chicago Professional Colleges.

which are ventilated separately. The cubicles are arranged at the corridor end of the room. These can be used for experiments not contagious to humans.

Feed and bedding rooms should be fireproof, rodent- and vermin-proof, and easy to clean. Somewhere in the animal facility a room should be provided for storage of clean cages and racks not in use. Several small rooms for cleaning equipment, disinfectants,

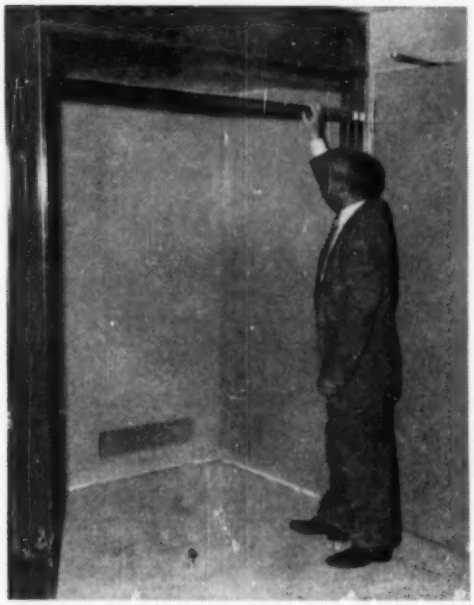

Fig. 1.—Close-up of isolation cubicle in Chart 2, showing the sliding glass door. Each cubicle will accommodate one rack of cages.

and other materials of this type should be provided. These items should not be in the feed and bedding storage rooms.

Some institutions have used movable partitions for experimental animal rooms to give flexibility. The control of vermin may be more of a problem with the hollow, movable partitions than solid walls, unless they are sealed properly.

The development and construction of quarters for dogs and monkeys deserve special consideration. The rooms for dogs or monkeys are usually larger than the ones for animals such as mice, rats, rabbits, and guinea pigs. The question of exercise rooms or runs is important from a public relations standpoint. Most of the proponents against the use of animals for medical research have centered their efforts around the dog. If it is possible to provide runs for dogs adjacent to pens, either outside or in the building, it is advisable. This does not mean that dogs

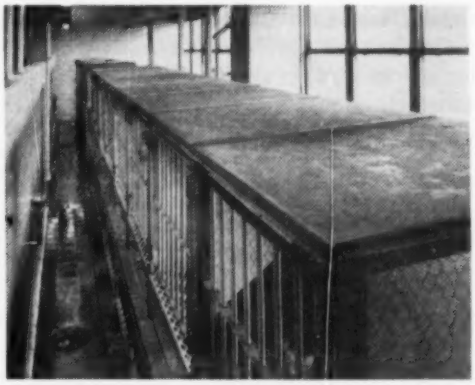

Fig. 2.—Dog cages showing the back of the cage, gutter and flush drain. Partial wall separates banks of cages as at Berg Institute, New York University, N.Y.

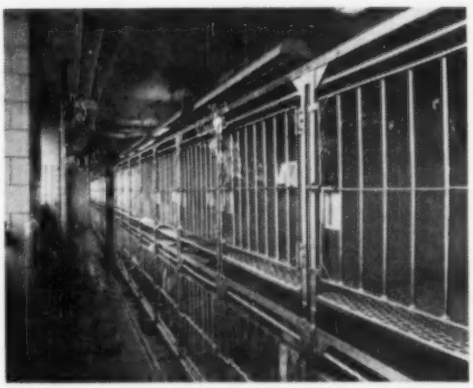

Fig. 3.—Front of cages shown in Figure 4. Note the use of flush drains.

cannot be kept in cages for specific experiments for reasonable lengths of time.

The necessity for cleaning dog or monkey cages frequently requires a type of fixed cage from which the refuse can be hosed down several times a day. The type of cage used at the Mayo Clinic and the Berg Institute, New York University, works very satisfactorily (Figs. 2 and 3). These are a modi-

fication of those used for some time at the University of Chicago and Northwestern University Medical Schools. These fixed cages can be arranged so that the refuse can be washed into a gutter and then to a flush drain. Similar rooms can be constructed for monkeys. Those used at the University of Wisconsin for long-term psychological studies have proved satisfactory.

The use of inside pens and outside runs for groups of dogs and monkeys has proved satisfactory where ground space and location permit (Chart 3). Those animal quarters which maintain and use large numbers of dogs should make some provision for a small treatment room with laboratory facilities to diagnose parasitism and other common diseases. The quarantine area for new dogs should provide facilities for bathing and cleaning. All dog kennel rooms should have a drop table and small sink for minor treatment and examination (Fig. 4).

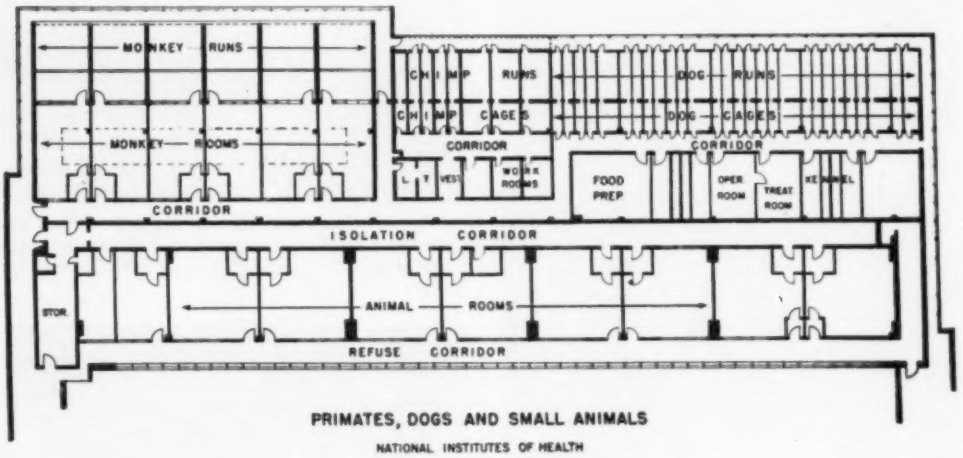

CHART 3.—Animal facilities including dogs, monkeys, chimpanzees and a small animal area. Note the extra corridor to separate completely the primates and dogs from the small animals at the National Institutes of Health.

Structure and materials.—Whether the animal quarters are a separate wing, building, or several floors of a medical center, it is assumed that sound architectural and construction engineering have been specified and planned. It is assumed here that the general problems of floor load per square foot, column size, and other such items are covered by general specifications and plans.

Modern fire-resistant materials should be used. Wooden frame construction should not be used for animal housing except in very special cases. The extreme difficulty in constructing and maintaining vermin- and rodent-free conditions renders ordinary frame construction undesirable. Concrete block structures represent a minimum type of construction. In addition to good basic design on the part of the architect, special care must be taken in the specifications and by the builder to eliminate recesses, cracks, and pockets which make cleaning difficult. There should be no communication between rooms such as the opening around piping, electrical conduit, water pipes, and telephone wires passing from room to room. Each animal room should be a completely isolated unit with no communication to adjacent rooms. Shelves, window ledges, and columns protruding into rooms should be avoided wherever possible. Any ledges or shelves, if unavoidable, should be slanted at least 45°.

Walls.—There are a great variety of wall surfaces which can be used. They should be of a smooth surface which can be cleaned

easily. If concrete or cinder block partitions are used, they can be painted or treated with many different compounds. These should be of a moisture-resistant material. Glazed tile wainscoat or wall is impervious but can be damaged from cage racks. Synthetic rubber and plastic base paints have made available a wall covering material which can be applied to cinder or concrete block walls.

The use of cement enamel applied to concrete block walls is generally available and makes a durable finish. The Medical

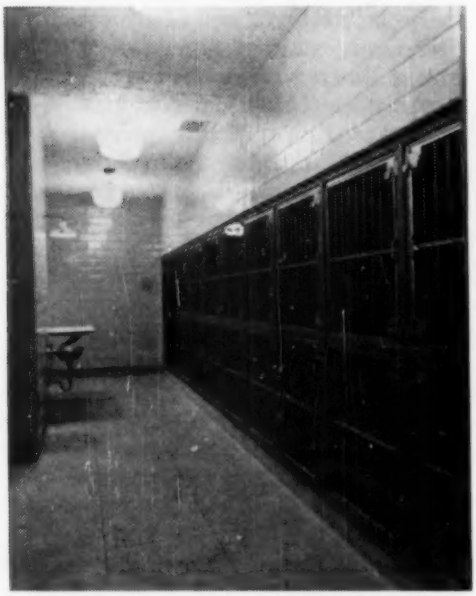

FIG. 4.—Note the examination table and small sink at the National Institutes of Health.

Department, Brookhaven National Laboratory, Upton, Long Island, has used this cement enamel with good results in its animal quarters, especially in the dog kennel areas.

Although every precaution may be taken to protect walls from damage by movable racks, there are two items which will go a long way toward preventing such damage. One is the use of a curbing at the floor in corridors and areas where cage racks are moved frequently (Fig. 5). The second concerns doorways, which should be a minimum of 3 feet in width and, preferably, 3½ feet. Recessed hardware on doors will also prevent damage to doors and walls. In areas with heavy traffic, the use of photoelectric equipment to open doors will prevent much damage. Pressure pads to accomplish the same results have been satisfactory but are subject to wear.

Animal room floor materials.—Animal room floors are one of the most difficult parts of construction for which to find a completely satisfactory material. It has been shown that wooden floors are completely unsatisfactory and should not be used under any circumstances as the finished

FIG. 5.—Note the curbing at wall-floor junction to protect wall surface from racks at the National Institutes of Health.

floor surface. They cannot be cleaned properly, and the joints and cracks which develop provide excellent places for vermin and disease-carrying materials. The fact that wood absorbs urine is a constant source of increased animal room odors. Concrete is probably the most common material and, if compacted and troweled well, is probably the most satisfactory material to use. It will, however, tend to disintegrate over a period of time under the action of certain organic salts and acids in urine. Concrete can be treated with silicon material, and if this treatment is carried out properly, a cement floor can be used for a long period of time.

There have been numerous instances

where the cement finishers employed by the contractor have nullified the best plans and specifications laid down by the architect. The common practice of sloping a concrete floor $\frac{1}{8}$ inch to the foot is consistently unsatisfactory. Some finished floors have actually sloped away from the drain. Where animal room floors employ drains, $\frac{1}{4}$ inch slope per foot should be recommended. In dog kennel rooms with built-in tiers of cages, $\frac{3}{8}$ inch slope per foot is not too much in the gutter area when they are washed down several times a day. It has been reported that there are certain plastic materials containing sand quartz and other aggregates which are as resistant to wear and abrasion as concrete. This type of floor surface is reportedly somewhat flexible, does not develop cracks, and is easily repaired if it should become cracked or damaged. The permanency of these compounds should, however, be investigated.

Quarry tile is a common type of floor covering in many animal facilities, especially in dog and monkey areas. If this material is laid with acid-proof mortar, it forms an impervious satisfactory surface. It should be laid on a well seasoned concrete sub-floor; otherwise, cracks will develop between the joints. A quarry tile floor is slightly rough, owing to the joints, and probably not as satisfactory in traffic areas as heavy-duty concrete.

Terrazzo-type floors with acid-resistant material have been used, but they have a tendency to crack and are not as satisfactory as quarry tile. Asphalt, rubber, and vinyl tile are used in some animal quarters. They require special care and cannot be recommended where quantities of water and urine are on the floor. The newer rubber and vinyl tiles give considerably longer life than the older types but do not compare with concrete or quarry tile. They usually develop depressions from the wheels or legs of the cage racks.

A water-proof material or diaphragm should be laid under any floor surfacing. This should extend up the wall not less than 3–6 inches. Any floor surfacing should end at the wall with a cove forming the joint above any possible water level.

Floor drains.—The problem of drains could well be covered under the heading of floors; however, they are of such importance in the dog and monkey areas that emphasis should be placed on their proper use. The need for floor drains in small rodent rooms is questionable, if the floors are swept and damp-mopped. If the floors are not wet-mopped frequently, and it is not the practice to hose down the room at intervals, there is probably no real need for drains in many animal quarters. Many consider a floor drain essential, even in small rodent rooms, to remove water from periodic scrubbings and hosing of the rooms. A disadvantage of floor drains, particularly in small rodent rooms, is the tendency of the caretaker to use this drain as a convenient disposal chute, with eventual clogging.

In those rooms where the drains are used only occasionally, a solution to this problem is found in the provision of drains with locked covers. These covers should be tight, as the water seal in the drain trap will dry out and provide a means for vermin to enter the room. The drain can be opened when necessary under the supervision of the foreman. In some areas, as in rooms with built-in dog cages, a floor drain is practically essential.

In these areas it is suggested that hair traps be installed in the drains, otherwise they become clogged with hair and other material. In general, it may be said that the usual practice is to have floor drains in dog rooms and in monkey rooms, since these cages are so frequently cleaned in the room with a hose and brush. Drains in monkey colony rooms where the animals are loose in the room should have locked covers when not in use. The use of drains in rabbit and guinea pig rooms is a matter of individual preference.

A more expensive but extremely efficient type of drain is found in the dog colonies of a few institutions, and, at least in one institution, in all animal rooms. This is a flushing floor drain, manufactured under the

name "Oriental Closet Fixture." These are flush drains much like an ordinary toilet bowl set in the floor. Surprisingly large amounts of material can be swept into these drains and flushed with no danger of clogging. They are especially valuable in dog colony rooms with built-in cages where the urine and feces can be hosed or brushed into gutters with these drains and flushed away. In dog rooms, these drains are probably the most important single labor-saving item which can be installed. This type of drain is more expensive than others because of the accessory flushing equipment needed, but may be economical in terms of long-term labor saving. Proper plumbing to prevent back flow into the water supply is essential. If these are used in animal rooms where bedding material is to be disposed of in this way, consideration must be given to the type of sewage disposal system needed. Obviously, disposal of wood shavings or sawdust into septic tanks or cesspools would not be advisable. While the proportion of this material in the sewage of a municipality would probably not be large enough to interfere with the operation of sewage treatment plants, local ordinances may prevent the dumping of such material into the treatment plant.

Ceilings and light fixtures.—The general construction of the animal facilities will determine whether it is necessary to have a suspended ceiling which will conceal all duct work and piping or whether the duct work and piping will come from a common plenum, usually in the corridor ceiling. In any case, the animal room ceiling should be a smooth surface so that it can be cleaned or painted readily. If it is plaster, it should be securely bonded to metal lathe. In general, it is better not to have suspended ceilings, since the area between the ceiling and the weight-bearing floor above, or roof, affords an opportunity for vermin to get into the building. Ceiling lights should be recessed, and the daylight-type fluorescent lamp makes a good light for animal rooms. In connection with the lighting and outlets, there should be double convenience outlets in several places throughout the animal room for the use of portable electric equipment. If these outlets are not in use, cover plates should be put over the area so there is no opening to adjacent rooms.

Ventilation and heating.—This is probably one of the most important problems in planning the animal facilities. In almost all instances it is important that air conditioning be provided for animal quarters. This, however, cannot always be done; therefore, the matter of constant temperature and adequate changes must be carefully studied. Each animal room should have its own ventilating or heating control system, and the air pressure in rooms should be higher than in the adjoining rooms. The air should not be recirculated for any animal room.

The introduction of air into animal rooms should be with perforated duct work rather than the ordinary circular grills. This prevents drafts which contribute to chronic respiratory infections and difficulties in the laboratory animals. A number of investigations have been made concerning the heat output of various species and the air changes required for acceptable odor levels and comfort of the animal (1, 2, 11). A number of workers with animal facilities have pointed out that the temperature in an animal cage, e.g., in mice, is usually 3°–4° higher than the room temperature. This is due to the heat output from the animals themselves.

There is considerable variation of opinion on the best temperature at which different species of animals should be kept. In general, rats, mice, and guinea pigs will be about the same, 72°–76° F. Some workers are of the opinion that rats should be at a lower temperature. Monkeys, on the other hand, are usually kept at a higher temperature, 75°–78° F. The various recommendations on temperatures by species are summarized by the National Institutes of Health for publication by the National Research Council. This publication is now in preparation or in press and should be consulted when available.

Six changes of air per hour are considered adequate for human habitation, but not for

large numbers of animals. Ten changes per hour are more acceptable. This requires care in the design of the air outlet into the room to prevent drafts. This requires large ducts and perforated outlets which are more satisfactory.

It must be remembered that the total animal surface exposed in an animal room is much greater than in a similar room for human habitation. The food and excreta in animal rooms are not ordinarily found in human habitation. The air should not be recirculated, since this is a possible means of transmitting disease. The supply of fresh air must be tempered during the winter in most areas. If heating of the rooms in winter is necessary, thought should be given to supplying heat to the rooms through the ventilation system. Even temperatures throughout an animal room can be attained in this way, and it has the advantage that radiators and other heat-producing dirt-catching devices are not needed in the rooms. A combination of radiant heating coils in the floor and ventilating air has been used in some cases. Heating of the supply air, however, lowers the relative humidity, and in the winter time it may be necessary to humidify the air by means of water sprays in the system. Complete air conditioning, although expensive, is the most satisfactory system; others will present the problem of maintaining constant temperature and humidity. It has been shown that there should be some overage in regard to the change of air volumes, since planned occupancy in the proposed animal quarters is often lower and there should be some allowance for increased numbers of animals in any given animal facility. There have been a number of publications describing the environmental temperature and its effect on the health and behavior of various species of animals (3–10). These are worthy of study by those planning animal quarters.

Plumbing.—Sinks should be of stainless steel, especially high nickel alloys such as series 318. These are readily cleaned. They do not damage easily and can be repaired satisfactorily. Each animal room should have a sink with backboard and drainboard. In a large room, two sinks should be provided. They should be set away from the wall at least 4 inches to facilitate cleaning. If the sink and backboard are flush against the wall, they should be sealed by a non-cracking caulking compound. No cabinet space should be provided below the sink or drainboard. This space only provides a place for collection of unused equipment and a place to harbor insects. All faucets should have hot and cold water with a mixing bib which is threaded for a hose connection. If hoses are used for cleaning the animal room, hot and cold water faucets are usually placed directly on the wall and not at the sink. All faucets should be equipped with anti-syphoning devices.

Fixed watering devices to cage racks have not proved satisfactory and are not recommended. All pipe openings through floors or walls should be carefully sealed.

Caging and cage washing.—There are a wide variety of cages used for the small experimental animals. Most institutions will use the type of cage which the investigator insists he needs; thus, only general guide lines will be pointed out here, since the details on the various types of cages are presented elsewhere. A great deal of flexibility and saving of money can be accomplished by the use of a general purpose cage which can be used for rabbits, guinea pigs, rats, mice, hamsters, and, in some cases, small monkeys. This depends entirely on the type of experiment on which the animals are placed. Such a procedure was followed by the National Institutes of Health in their development of a general purpose cage, used in both the animal production section and the experimental areas. The same procedures can be followed with reference to dog cages which can also accommodate monkeys, cats, and small chimpanzees.

Stainless steel is the best material from which to construct animal cages. It is durable, corrosion-resistant to animal excreta and urine, and will outlast any other material. It is true that the initial cost is greater than galvanized metal; however,

replacement and repair will be much less. Cages should be continuous seam-welded and polished to provide a smooth surface, rather than spot-welded, which results in crevices from the overlapping. Monel metal has been found to corrode when exposed to urine. Glass jars have been used successfully in many animal colonies, particularly for mice, as have certain types of plastic cages. The problem with plastic cages is the effect of repeated exposure to high temperature used in cleaning which may be necessary to prevent the transmission of infections.

If an institution is planning an expansion of their animal quarters to the extent that it justifies mechanical cage washing, then it becomes necessary to standardize on the design and size of cages and racks. This has been done successfully in several places and will not hinder the experimental work but aid it by reducing the cost. An inch or 2 in length and width of cages is not critical and is far outweighed by the advantages if the size of the animal facility justifies mechanical cage washing. This necessitates that an early decision be made on the type of washing equipment, so that cages, racks, and the washing equipment will coincide.

There are a number of cage-washing machines which have been employed in animal facilities, and the type selected is determined to a considerable extent by the number and kinds of cages and racks that must be cleaned and washed. Although it is an operational problem, it should be kept in mind that adequate removal of the bedding, urine, and organic material, previous to washing the equipment, will add much to its efficiency. The machines used for cage washing are similar to dishwashing machines and consist of patterns of nozzles which should provide wash water at a pressure of at least 25 pounds per square inch. The cages and racks are rotated or moved by conveyer. In most instances, a tunnel type or conveyer type of washer is used for the cage and a rotating type of machine for the cage rack. In small installations, large tunnel-type dishwashing machines have been converted to cage washing.

The equipment should produce water temperature ranging from 140° to 180° F., the lower range for washing and the higher for final rinse. The installation of a cage-washing machine for either racks or cages will require that wash water tanks, rinse tanks, and pumps be located in a pit below the floor level. Stainless steel construction should be used in this equipment. There are a number of facilities where the entering end or soiled cage area of the washing equipment is separated by a tight wall built about the middle of the washer forming a refuse and clean area. The rooms in which mechanical cage-washers are placed should have special ventilation to take away the excess heat and moisture.

If an expansion of animal quarters is contemplated, which will require the installation of cage-washing equipment of the type outlined above, those responsible for planning should observe the various types of machines in operation. It should be emphasized that, in the use of mechanical cage and rack washing, some standardization of equipment will be necessary.

ACKNOWLEDGMENTS

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REFERENCES

1. BENEDICT, F. G., and MACLEOD, G. The Heat Production of the Albino Rat. I. Technique, Activity Control, and the Influence of Fasting. J. Nutrition, 1:343–66, 1929.

2. ———. The Heat Production of the Albino Rat. II. Influence of Environmental Temperature, Age, and Sex: Comparison with the Basal Metabolism of Man. *Ibid.*, pp. 367–98.
3. CHEN, K. K.; ANDERSON, R. C.; STALDT, F. A.; and MILLS, C. A. Environmental Temperature and Drug Action in Mice. J. Pharmacol. & Exper. Therap., **79**:127–32, 1943.
4. FULLER, R. H.; BROWN, E.; and MILLS, C. A. Environmental Temperatures and Spontaneous Tumors in Mice. Cancer Research, **1**:130–33, 1941.
5. KELLMER, L. A. The Effect of Temperature on the Behavior of the White Rat. Am. J. Psychol., **56**:408–21, 1943.
6. MILLS, C. A. Environmental Temperatures and Thiamin Requirements. Am. J. Physiol., **133**:525–31, 1941.
7. ———. Influence of Environmental Temperatures on Warm-blooded Animals. Ann. N.Y. Acad. Sc., **46**:96–105, 1945.
8. MILLS, C. A., and SCHMIDT, L. H. Environmental Temperatures and Resistance to Infection. Am. J. Trop. Hyg., **22**:655–60, 1942.
9. MUNKELT, F. H. Air Purification and Deodorization by the use of Activated Carbon. Refrig. Eng., **56**:6, 1948.
10. RUDDY, J. M. Air Conditioning Rodent Quarters. Heating and Ventilation, **49**:95, 1952.
11. STOECKER, W. F. Refrigeration and Air Conditioning. New York: McGraw-Hill Book Co., Inc., 1958.

Design and Construction of Animal Quarters for Medical Education and Research

E. VERNON BARKER, Architect
Office of Architects & Engineers, University of California at Los Angeles

The architect's function.—It is perhaps apropos to preface any remarks about the design and construction of animal quarters with some information about the architect's duties and responsibilities to the client. Architects don't usually have a chance to sing their own songs. By the time they have been invited to meet with their prospective clients, they have been subjected to an exhaustive investigation, and are usually appointed on the basis of experience, competence, and reputation. The architect is supposed to be a combination of many ingredients, like a good salad. He is thought of by many as an expert planner, heating and ventilating engineer, lighting expert, and a construction specialist. And, if he stays in practice very long, he must also be a business man. There are usually various and sundry sorts of limitations placed on every project. These limitations include the site, type or purpose of building, its location, and the client's predetermined ideas and bank account. After a series of conferences, which sometimes appear to be the psychoanalysis of the client (time-consuming and expensive), he has found out certain objective things: what the client wants to do in the new structure, how he intends to do it, with how many other people, what sort of mechanical devices and equipment he needs to assist him, and why he plans to build something that generally costs more than he has or wants to spend.

When these questions are answered, the architect prepares a sketch or drawing called a "preliminary plan." This will show the general arrangement of rooms and facilities, the number of stories, the type of construction, and an outline specification of materials and finishes, both inside and out, and which explains briefly the mechanical and electrical systems, and other basic pertinent information. When the client is satisfied that these small-scale plans show what he wants, he tells the architect to go ahead with the working drawings. During this stage, the client has somehow caught on to the idea that this is a wonderful time to change his mind; and it really is, too! Because if he waits until the contractor gets it half built, he is sunk (or his bank account is). Change Orders to the contract are always expensive, and it is much cheaper to change lines on paper than to change concrete and steel.

When these working drawings and specifications are completed, they are usually an imposing pile of paper. The cost of their compilation also represents a major part of the architect's fee. The plans for Unit I of the University of California Medical Center at Los Angeles comprised over 450 sheets of drawings 36″ × 48″. One set of these blue prints weighed nearly 100 pounds, and the specifications weighed 11 pounds. This job was budgeted at around 20 million and created a lot of interest. We printed some 175 sets of these plans, and it can be readily seen that this comprised a pile of paper. The important thing, though, was that this pile of paper in blue print form represented all the ideas, imagination, creative ability, research, and just plain hard work, of a hundred people, more or less, for several years.

Money, hard work, and imagination; without imagination, no progress can be made. We can usually play it safe in the same old grooves, or, we can use imagination, ingenuity, and proceed aggressively to develop what we hope are good or new solutions. We make mistakes, but, in so doing, we make some progress too. The architect should not get all the credit, nor does he deserve it, even though he sits on the platform at the dedication and is introduced as "the man whose vision and thoughtfulness, careful planning, and personal attention to each problem and its successful solution has helped to make this magnificent edifice possible."

The project planning guide and building program.—The basis for a well designed building is a good, well organized, and well thought-out program. By program, is meant the specific requirements, the exact and detailed account of what the client's real needs are, and many times—in fact, more often than not—the client does not know or is not sure of what he wants. There are some questions that can be asked at this point.

Should the architect be concerned with compiling and analyzing the spaces in a proposed building and evaluating the clients' need?

Is such a job a part of his training?

Does the fee contain this time-consuming element of planning?

It is the growing opinion in many institutions that the trained planning analyst can make a most valuable contribution at this stage. His training and experience lead him to ask the right questions of the client. Although there is always something basically personal about the requirements, the analyst is mindful of the objective function to produce a sound and solid program, which, converted to building space, provides the client with the facilities he needs to do his work. Mr. Nathaniel Becker, of Becker & Becker, Associates, of New York, says in his excellent article in the *Journal* of the AIA, April, 1959, "Space analysis, or the programming of the 'Human' use of space, may be described as pre-architectural planning as practiced by an objective, disinterested third party. In more specific terms, it is a logical and orderly system of investigation into the requirements of space in a given or proposed structure. Its aim is to determine how much space is needed, by whom, in what capacity, how often, what size, what kind, where, and why. This investigation subsumes a thorough understanding of architectural problems as affecting the final building solution, but it does not presume to usurp, not even in part, the central and irreplaceable role of the architect as *premium mobile*, or creator."

Whether by "planning analyst," or architect, most of the information pertinent to the project must be tabulated and assembled coherently before any plans can be developed. There are always numbers of people to please, and the architect may be also under limiting instructions from higher authority. Regents and Boards often indicate a lively interest in new buildings and plans, often from the standpoint of ultimate objectives, possibilities of change in emphasis of certain research projects requiring special facilities, and are always interested in costs. It can happen that the architect may please the Regents, the President, or an important donor, and displease the future occupants of the structure. I have not found the solution to this situation, and so far we just live with it. In the final analysis, the architect must come up with an acceptable solution in a reasonable length of time. He cannot afford to analyze and design without limitation, and there will always be some other way to do it.

The objective is to fulfill the client's requirements with optimum efficiency. The planning committee, if such there be, should guard against "individualism." There is a sizable stake in the construction of buildings and to build inflexibly around an individual may later prove costly. We have found the Space Data Sheet (Chart 1) most valuable in determining the needs of the program and in calculating the assigned square footage or net useful area of the building. This helps tremendously with the budget and a

calculation of the building cost. It also provides the architect with data on what sort of space is required and what goes in it.

At U.C.L.A., this is the Planning Analyst's work. It makes up into a convincing and imposing document. Says Dr. George Larke, who directs the Planning Analysts Division of the Office of Architects and Engineers at U.C.L.A.: "The building program document contains information essential to the planning process: e.g., maximum number of assigned occupants; hourly utilization per week; type of space; building location preference; special requirements, including services and utilities, furniture and other equipment. These data must necessarily be explained and justified in terms of anticipated uses and purposes, and the student, staff and education program needs which will be met by the proposed spaces and facilities."

Since, obviously, there is an infinite number of choices, the problem becomes that of choosing the optimum in order to minimize some value parameter, usually cost. However, it may not necessarily be just the cost of the building which should be minimized, but rather that of the total project and its continuing operational costs. It might also be land utilization or site limitations.

In the programming stage, no facility not directly connected with the care of animals should be included in the quarters. Laboratories, shops, offices, classrooms, etc., not related to the housing and care of the animals should be located elsewhere. Such unrelated facilities bring in unnecessary and unwanted people and materials, and this not only promotes the spread of infectious materials but takes up the space which should be totally reserved for the function of animal housing and care.

General design criteria.—In the general design consideration, public relations occupies a prominent place, in this field particularly. The location of the facility with relation to the community, The Medical School or Research Institution or other academic buildings will have its influence on the layout and design. Some institutions have public tours, though they do not usually include tours of the animal quarters.

At U.C.L.A. the animal quarters consist of six floors adjoining the Medical School laboratories. Because of proximity to other University buildings, sorority houses, apartments, etc., it was necessary to plan a structure without openable windows. This has worked very successfully, although some researchers believe it would be better if the dogs could have outdoor runs.

All architects and engineers have their own ideas of designing good functional buildings. No one can say that this or that is "the best," though we will admit some buildings are better than others. At the National Institute of Health at Bethesda (N.I.H.) the design principle is to bring everything into the animal quarters on one side, the "clean" side, and take everything out on the opposite or "dirty" side. Dr. Bennett Cohen, D.V.M., of the Office of Animal Care, U.C.L.A., and Dr. Thomas Haley, of the Division of Toxicology of the Institute of Nuclear Medicine, Atomic Energy Project, U.C.L.A., both agree that "This ideal plan is good only to the extent that all personnel recognize the reasons for it and faithfully operate the plant with respect to it. Infectious materials carried from one area to another by people are just as deadly as if they were carried by the animals." If the functions are properly related to one another in the plan, good operation becomes more a matter of the techniques employed by all personnel working in the animal quarters.

Details of construction.—Waterproof membranes in multi-storied buildings should extend up the wall surfaces at least 24″ to insure no leaks. Floor drains should never have less than 4″ outlets, and electrical services inside the rooms should be up 5 feet above the floor.

The floor surfaces are, of course, the most critical of all finishes. A costly, but permanent, floor was installed in the animal rooms at U.C.L.A. After 5 years, it shows no signs whatever of any deterioration. It consists of acid-proof brick 4″ × 8″ × $1\frac{1}{4}$″ thick

PROJECT _____ SPACE NO. _____

_____ DEPT. _____

PHASE OR STEP NUMBER _____ DIVISION _____

A. TYPE OF SPACE _____ Total No. of Identical Spaces _____

1. DIMENSIONS (minimum in feet) _____ AREA _____ ASSIGNABLE SQ. FT.
2. TOTAL NUMBER OF ASSIGNED OCCUPANTS _____
3. TOTAL NO. OCCUPANTS AT ANY ONE TIME _____ UTILIZATION _____ HRS./WK.

B. PROPOSED USE OF SPACE _____

_____

_____

C. LOCATION PREFERENCE (FLOOR) AND RELATIONSHIP TO OTHER SPACES (IF ANY):

_____

_____

D. SPECIAL SPACE REQUIREMENTS

1. AUDIO VISUAL _____
2. CHALKBOARDS - LENGTH _____ QUANTITY _____
3. VIBRATION AND/OR NOISE PRODUCING EQUIPMENT (Describe) _____

_____

4. TEMPERATURE AND/OR HUMIDITY CONTROL _____
5. EXTRA ACOUSTICAL REQUIREMENTS (Describe) _____
6. FIRE AND/OR HEALTH HAZARDS - YES _____ NO _____ DESCRIBE _____

_____

7. OTHER (Intercom, TV outlets, etc.) _____

_____

E. SERVICES AND UTILITIES

1. SPECIAL ELECTRICAL OUTLETS: YES ____ NO ____ DESCRIBE _____

2. GAS: YES ____ NO ____ 3. AIR: YES ____ NO ____ 4. VACUUM: YES ____ NO ____

5. ASPIRATORS: YES ____ NO ____ 6. SINKS: YES ____ NO ____ QUANTITY _____

7. FUME HOODS: YES ____ NO ____ QUANTITY _____ 8. WATER: YES ____ NO ____

9. OTHER: _____

F. FURNITURE AND EQUIPMENT (occupying floor space)

QUANTITY	DESCRIPTION	QUANTITY	DESCRIPTION

Prepared by: _____ Date: _____

A&E Form 401b - Dec. 1958

CHART 1.—Space data sheet

embedded in a layer of red Fernane which was spread over the Portland cement grout bed. The joints were then filled with a glass-like black material which provides a tight seal around the joints, does not crack or sprawl out or shrink away from the bricks. This may sound simple (but watch it); be careful to install the floor drains *lower* than the surrounding floor areas. The plumber sometimes manages to install them slightly higher than the finished floor, and they are expensive to change and a nuisance forever if they are not. It's better to slope the floor slightly about $\frac{1}{8}''$ to $\frac{1}{4}''$ to the foot toward the drains. Another and very acceptable method is to slope the floor to a trough at the rear wall, which empties into a drain. This promotes good housekeeping, as it's easy to flush the floor clean and into the trough. However, with a drain intake out of sight below the floor level, it takes attention to prevent its clogging up. If sprays or nozzles are used to clean floors and stalls, the electrical engineer will want vapor-proof lighting fixtures and wall outlets. There should be no exposed piping or duct work in any animal room. They are dirt catchers, and expansion and contraction will produce cracks in walls or floors where they pass through. Cage pipe racks, brackets, etc., if installed on walls should be tightly and permanently sealed to the wall surfaces so that there are no cracks.

For some reason that the engineers evade answering specifically, ventilation in animal quarters is nearly always inadequate. A large sum is being expended at the present time at U.C.L.A. to correct the original and inadequate designs. Such alterations upset the whole facility and cause untold inconvenience to everyone, including the animals. The ventilation system should provide from twelve to eighteen air changes per hour, without drafts or stratification, and should be designed for reasonably close temperature control, each room separately, and with no recirculation. Failure to provide tempered air within the specified tolerances can be disastrous. Dr. Sydney Roberts, Professor of Physiological Chemistry at the University of California School of Medicine, Los Angeles, covered the situation, after a temporary failure of the air-conditioning system, with this cryptic remark, "My mice are dying like rats." Months of valuable time and research effort can be lost by a failure of the ventilating and cooling systems. Plus or minus 5° seems satisfactory for most areas, unless some exceptional problems must be met. Temperature controls within closer tolerances are very expensive. The need for this should be carefully analyzed, because the costs of such controlled environment rooms can double, or more, the costs of the other spaces. This is a part of the program, and the need should be justified.

Cage-cleaning, sterilizing, decontamination, and like functions—these belong to the veterinarian. The designs should reflect the procedures to be employed, and the Architect needs to work closely with the staff to provide adequate space and the proper equipment. There seems to be as many variations in these facilities as there are people who use them. The architect can't out-guess them, but neither should he be content to provide facilities for this purpose which he considers inadequate. There are many and varied techniques employed in this area, and close, detailed attention to the specific requirements is necessary.

There should be a storage room for clean cages, unless one is satisfied to have the corridors filled with them. Monkey cages take lots of space and probably need cleaning oftener than most others. Dog cages, too, take lots of space.

Movable cages should be equipped with stainless steel casters with nylon or other noncorrosive type wheels. They are expensive but pay dividends in the long run.

Animal operating rooms need about the same considerations as hospital operating rooms. Tempered air conditioning, conductive floors, and operating room lighting should be provided. Accessible supplies and instruments need space conveniently located. Electrical outlets, if placed up 5′-0″ high, eliminate the need for expensive

explosion-proof fixtures and meet the approval of N.F.P.A. Relatively small spaces, with all necessary equipment readily available are satisfactory for most teaching and research demands.

One should provide vertical transportation entirely within the animal area. The elevator or elevators should be restricted to the use of personnel working in the area.

If the plans for the Medical School, or other institute, are for multi-story buildings, there is a great advantage in integrating the animal quarters floor by floor with the research and/or teaching facilities. The animals relating to the work can be housed on the same floor. The advantages of this are obvious.

Incineration and disposal of waste materials are among the most important functions. In Los Angeles, where all disposal by incineration is under the eagle eye of the Air-Pollution Control Board, it becomes a major design problem, and an expensive installation both as to equipment and space. This activity is a dirty business, and the incinerator should be separated and off to one side, behind, or in a separate nearby structure. Related to it should be facilities for cleaning cans and/or other refuse containers. Waste materials should go in on one side, the containers passing through, cleaned and stored in a clean room for redistribution. A screened storage area should be provided for rubbish that can, and should, be hauled away for disposal. The best facilities can be ruined in a few short months by improper operation. Don't pick the cheapest man on the payroll to operate an incinerator. If it's a good one, it has expensive and complicated controls. The grates and fire box linings can be burned out in a short time by misuse, and, even if the expense of rebuilding does not seem to worry anyone, it will worry them if they have no incinerator to use for a month or two while it's being rebuilt. Plan plenty of space around the charging doors. If possible, design so that waste materials are fed into hoppers which discharge downward onto the grates at a lower level. If this is properly done, it will eliminate the hazard of flame blasts injuring operators when access doors are opened directly into the burning chambers. Plenty of room should be provided for week-end accumulation, or else operating personnel kept on duty over week-ends and holidays.

The preparation and disposal of radioactive wastes are becoming a problem in most institutions. Since this activity is under the direction of a Radiation Safety Engineer, the facilities for disposal must be under his control. They do not necessarily belong as a part of the animal quarters, but can be planned in conjunction with them, especially the crematory. Facilities for preparation for disposal by encapsulation in concrete, or liquid dilution tanks, etc., should not be in the animal quarters.

Plan "A" (Chart 2) shows, as the lawyers say, "a hypothetical case," an arrangement of facilities, based on certain "ifs." As mentioned previously, if the research and teaching facility is multi-storied, then the animal quarters should be too. If there are to be several stories, the general service functions should be on the ground floor. Plan "A" shows an arrangement for this floor, with receiving at one corner and disposal at the opposite. It provides space for a series of receiving-holding rooms which should contain facilities for quarantine and decontamination for outside animals infested with the commonly occurring pathogens or infections. As mentioned elsewhere, prevention of contamination through personnel becomes a matter of technique and good supervision. This floor contains offices for the administrative personnel and a chance to control the traffic through the area. This disposal and incineration area could be isolated, if desired, such as a separate building, and there are things to be said in favor or it. However, as long as it's entirely separated from other functions, and good techniques are employed in its operation, it will function well as shown.

Plan "B" (Chart 3) shows a typical arrangement of animal rooms on another floor level with animal surgeries. The planners should keep in mind the need for many rela-

tively small rooms, with a few larger ones for larger animals like monkeys and dogs. A "small" room would be about 150 sq. ft., with the larger rooms perhaps 275–400 sq. ft.

Monkey rooms should always open off vestibules or closed corridors so the animal can't escape if he manages to get out of his cage, and he often does. Consideration should be given to the caging of wild animals and their isolation, if these are a part of the program.

Feed and supply rooms should be well ventilated, kept tightly closed, and rodent-proofed.

The necessity for outside dog runs is debatable. In many institutions they would create a public relations problem. Some researchers say the dogs respond to treatment better if they are allowed outdoor activity.

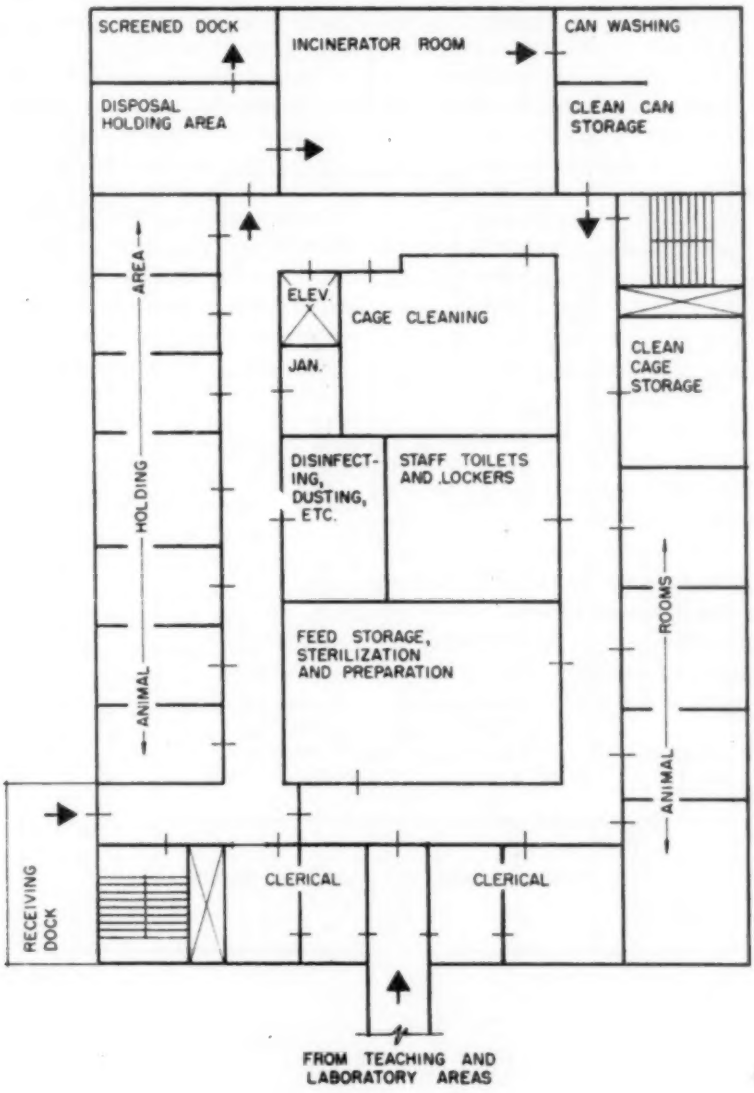


CHART 2.—Plan A

Others say it doesn't matter. It is a policy problem to be solved at each institution. Some institutions have placed them on the roof.

Cost and operations.—The architect should also consider operational costs in his designs. If the facility is to be built in increments, the basic utility and disposal facilities may be over-designed in the first unit. This has the expensive effect of running a big bus only half-filled with passengers, and the operation won't be economical until the next increments are constructed. However, this may be cheaper in the long run than expensive alterations and additions to basic services at a later time. Unit costs of animal care operations, i.e., costs per square foot of area, vary greatly and may mean nothing.

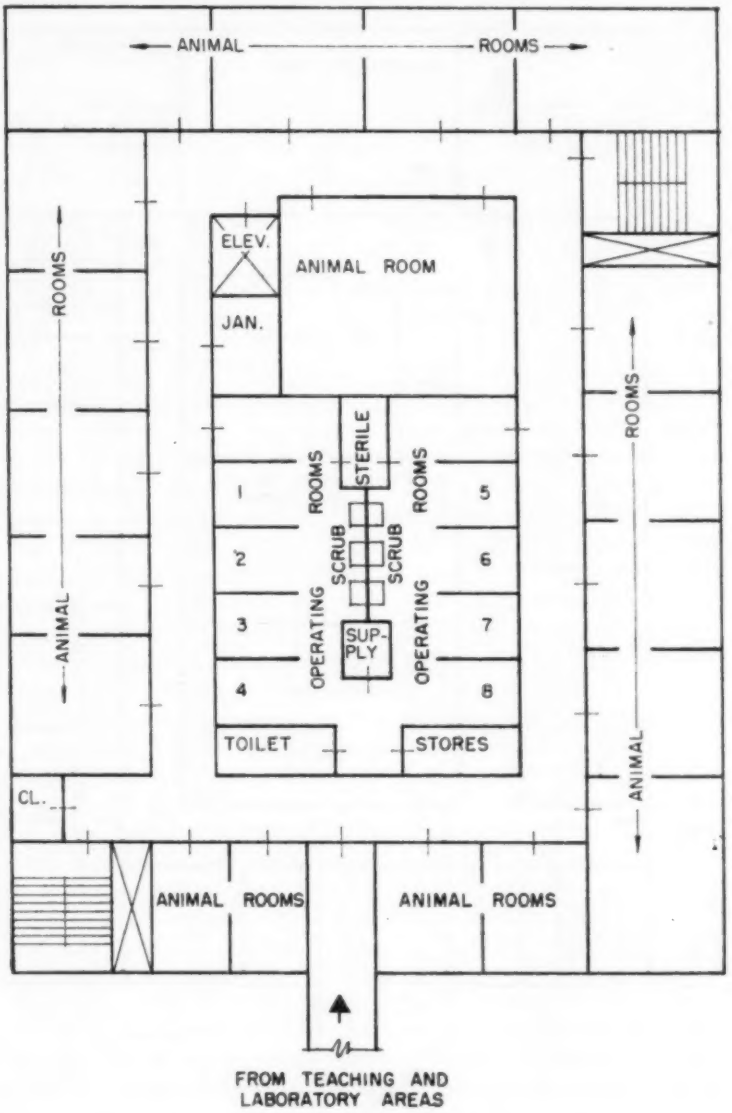


CHART 3.—Plan B

Some data are available but not quoted here. Comparatively speaking, structures for housing animals are about as expensive as other parts of the institution. These costs are influenced by the type of construction, the site conditions, elaborateness of interior and exterior finishes, and perhaps other factors. Complete air-conditioning, well controlled, is costly but mandatory. Good lighting is equally important. The epoxy sprays, acrylic materials, synthetic plastic paints, vinyl coverings, and other new materials are bringing better and cheaper surface finishes within the reach of all classes of construction, and the small tight budget can now afford these most useful materials, as well as those more elaborately planned. Manufacturers are making rapid progress in perfecting these materials, and it is well to keep oneself currently informed. Centralized animal quarters, constructed with centralized operations within them, are far cheaper to build and operate than spread-out departmental operations, where each department and/or division plans, constructs, and operates his own facilities. Annual operating budgets can sometimes equal one-fourth the initial construction costs, and, unlike the construction budget which is appropriated only once, the operations budget is a continuing thing. It is therefore an important responsibility of the architect to confer with not only the technical and research personnel who will use the building, but with the administrative and business office people who are experienced in operational costs, and whose advice should be sought and included as an important and integral part of the programming.

The architect should remember that his function is to design an "animal residence" and that the most important function is to provide for the comfort of the animals which will live in it. As Dr. Stafford Warren, Dean of the University of California School of Medicine, Los Angeles, says: "Because of the basic essential need for animals in teaching and research, it is more necessary to provide optimum comfort conditions, such as air conditioning, for the animal quarters than it is for hospital patients and other humans. The medical student, during his first two years of basic sciences, is as concerned with animals as is the third and fourth year student with humans. The quality of the student's education, and the quality and importance of the researchers' work are dependent on the effective use of animals, and their housing and care are, therefore, of the greatest importance."

Therefore, it is the architect's job to plan a structure of the highest efficiency possible, providing all the functional facilities required for the best use of the students', the researchers, and the academicians' time. If at the same time he has provided a structure which is architecturally pleasing, he may be justly proud of his small part in providing a major tool for the teacher and the research investigator in their continuing quest for the answers that are making life better for all of us.

Organization and Functions of a Medical School Animal Facility*

BENNETT J. COHEN, D.V.M., PH.D.
Department of Physiology, School of Medicine
University of California, Los Angeles, California

INTRODUCTION

Within the past 15 years at least 25 per cent of the Medical Schools in the United States have reorganized their animal quarters under professional direction (Table 1). In most of these schools the quarters now function as an institutional "central service." This trend is due primarily to the growing size and complexity of modern medical institutions and to the increasing specialization of research and its tools. Indeed, many ancillary functions other than "animal care" have been reorganized in this way, and new disciplines such as "instrumentation" and "visual aids" are increasingly prominent. The purpose of this discussion is to evaluate and describe the centralization concept as it applies to a medical school animal facility.

DEFINITION AND FUNCTIONS OF CENTRAL ANIMAL CARE

Responsibility for laboratory animal care and use traditionally has rested with the research worker. In the first decades of the 1900's relatively few animals were used, financial support of research was meager, housing facilities were poor, and maintenance procedures were haphazard. The adequacy of care depended on the investigator's interest and experience. Animal care standards varied greatly for different colonies within the same institution (3, 4). To some extent, in some institutions, animal care facilities and methods still are not completely satisfactory, a fact which, in part, contributes to the continued activity of anti-science groups (2).

Today, the importance of proper animal care in the control of biological experiments is well recognized. In recent years most institutions have greatly improved their animal quarters to promote better control. Further, laboratory animal care has achieved recognition as a specialized professional field (1, 3). The availability of specialists, in turn, has provided the key to successful centralized management.

Central operation has been facilitated in many institutions by locating the animal quarters on separate floors or in a separate wing of laboratory buildings. However, even where the quarters are scattered among the departments, they can be operated successfully as part of a central service.

The principal service functions of a unified operation are the procurement of animals, supplies, and equipment; maintenance of breeding colonies and stock animal pools as required; housing of animals during experimentation; provision both of routine and specialized care; and ancillary services such as cage washing, waste disposal, vermin control, and equipment maintenance. In some institutions operation of the animal surgery also is a central service function.

* This article is based in part on material presented at a symposium at the Royal Society of Medicine, London, May 5, 1958, on The Organization and Administration of an Animal Division, and published in *Laboratory Animals Centre Collected Papers*, 7:63–71, 1958. (Laboratory Animal Care; A New Discipline—L. R. Christensen and B. J. Cohen.)

Direction of the service is the responsibility of a faculty member professionally interested in laboratory animal care. Animal service personnel including the Supervisor, animal technicians, and animal care office staff are responsible through the "Director" to the participating departments and investigators (Table 2). In addition to these administrative responsibilities, the Director has teaching, consultative, and research obligations comparable to those of his colleagues.

The Director usually reports to the Dean through a faculty Committee on Animal Care which works with him in recommending operating policies to the Dean. The committee structure is the most democratic way to deal with legitimate departmental concern about space and services. Ideally, the committee should be representative of the departments participating in the service and composed of individuals experienced in the use of animals. The committee, the Director, and the centralization plan must have strong Dean's office support if the plan is to be launched successfully.

Opposition to this centralization frequently is based on its "bureaucratic implications." Some investigators regard it as an unwelcome departure from traditional patterns of animal care. They fear possible loss of responsibility and control over their research. They are apprehensive about the cost of a centralized operation and wonder whether their specific requirements can be dealt with equitably under this system.

None of these fears need materialize in a well run service. On the contrary, the investigator gains the assistance of a trained, dedicated group, while retaining full responsibility and control over his research. He loses only an unproductive administrative load. In this connection, one of the Director's most important obligations is to indoctrinate his staff with the ideals and duties of a service organization. His personality, interest, and attitude are crucial, since nothing will lead to more bitterness and opposition to centralization than a "bureaucratic" state of mind in service personnel. His own role as a teacher and research worker should also assure operation of the animal service from an academic perspective.

TABLE 1

MEDICAL SCHOOLS WITH PROFESSIONALLY DIRECTED "CENTRAL ANIMAL QUARTERS"*

University of Florida
University of Chicago
Northwestern University
University of Louisville
Bowman Gray School of Medicine
University of Washington
Seton Hall College of Medicine
Georgetown University
College of Physicians & Surgeons, Columbia U.
Albert Einstein College of Med., Yeshiva U.
State Univ. of N.Y., Downstate Medical Ctr.
University of Miami
University of Illinois
State University of Iowa
University of Buffalo
Vanderbilt University
University of Wisconsin
University of Missouri
Univ. of California, Los Angeles
Univ. of California, San Francisco
New York Univ., Bellevue Med. Center

Similar Programs in Development or Contemplated at:
University of Oregon
University of Pennsylvania
Harvard University
Yale University

* As known to the author 8–1–59.

ADMINISTRATIVE ORGANIZATION

The Table of Organization (Table 2) is a simple summary of desirable working relationships in a central animal service.

The Animal Care Committee, not the Director, officially determines operating policies. As a committee member, however, the Director recommends policies he believes are necessary and desirable. Obvious-

ly, the committee must delegate to him effective operating authority once these policies are established. Subsequently, it serves as a review and advisory body.

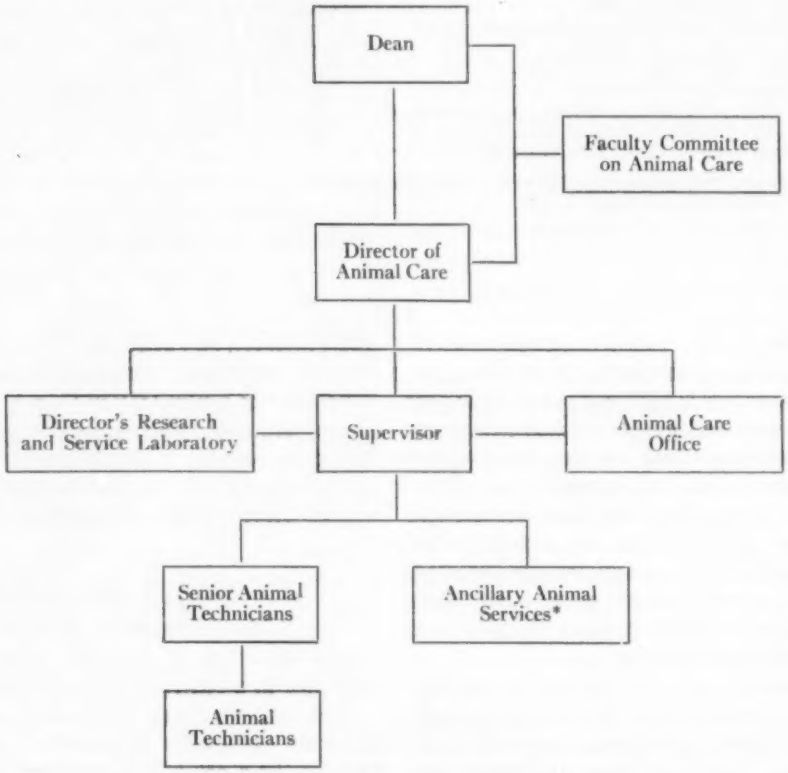
The Director, to be effective, should be a member of the faculty, not an administrator imposed on the staff, and not solely a technician at their beck and call. This means that he must be academically qualified.[1] In addition to his training as a veterinarian, physician, microbiologist, or physiologist, he must also qualify as a laboratory animal specialist. At least some of his research should be devoted to laboratory animal problems and should be of a quality to merit the respect of his colleagues.

The Supervisor is responsible for the day-to-day operation of the animal quarters. He must be thoroughly experienced in all phases of animal colony operation and its relation to teaching and research. He provides on-the-job training for the animal technician staff, develops work routines, and enforces established standards of care. In short, his role is to insure that the daily

[1] In a few institutions, however, the Director's position has been organized to permit part-time graduate study. For example, at Northwestern University two veterinarians have earned the Ph.D. degree while directing the animal facilities. This arrangement is most satisfactory where the animal colonies are of moderate size, and a centralized program is well established.

TABLE 2

ADMINISTRATIVE ORGANIZATION OF CENTRAL ANIMAL QUARTERS



* Cage washing; vermin control; equipment maintenance; waste disposal, and surgical services.

animal care requirements of all investigators are properly met.

Senior technicians occupy strategic positions in the animal service organization, and they too must be thoroughly experienced. Some may work as specialists, as, for example, in operating rodent or primate breeding colonies. Others may supervise animal technicians on a given floor, or oversee the ancillary maintenance activities.

The animal technician's major responsibility is routine care. The well trained technician is differentiated from unskilled labor by his understanding of the purpose of routine and its bearing on the control of experiments. Perhaps the greatest advantage of centralized care is the opportunity it affords to improve the training and broaden the perspective of this important group of laboratory assistants (see the paper by L. R. Christensen on Animal Technician Training in this issue). In a central service the variety of experience is enlarged for the technician, and he has a more satisfactory career opportunity than is ordinarily available to him as a direct employee of the individual investigator.

It should be emphasized, however, that centralization should not preclude full-time assignment of a technician to a given project or investigator. On the contrary, staff members with sufficiently large programs should be encouraged to utilize central service personnel satisfactory to them on a full-time basis. Furthermore, all technicians should have specific work responsibilities in a given part of the animal quarters, where they, too, must satisfy the investigators they serve. It may be stated here that the laboratory technician who uses animals during the course of a research project is not considered part of the central service. He is best employed by the investigator.

The animal care office serves as the administrative center for the animal service, in addition to carrying out the routine tasks of a departmental office. All animal orders are placed through this office, inventory and financial records are maintained, including billing for services. A list of approved sources of animals is kept; and the office is geared to meet emergency procurement requirements. These duties require the close collaboration of the supervisor, who provides necessary liaison with the animal quarters.

The details of administrative organization just outlined are the means to an end, not the end itself. They will of necessity vary from institution to institution, depending on individual requirements. In some instances the location of the animal facilities in widely separated buildings may preclude their operation in the specific fashion just described. However, the over-all objective should be to provide equitable, efficient, and economical management of the animal care problems common to all departments sharing a given laboratory facility. The test of a well run central service is the extent to which the investigator is willing to regard "animal care" simply as an extension of his own department, the group to turn to for his laboratory animal requirements.

SPACE UTILIZATION IN CENTRAL ANIMAL QUARTERS

Assignment of space may be the most difficult administrative problem in animal quarters. In many institutions space is at a premium, and competition for it is great. Under these circumstances only the Animal Care Committee can resolve conflicting claims and assure the most equitable assignment of the available facilities.

As the policy-making body for the animal service the committee, not the departments, should "own" all space. Assignment of animal rooms or floors should be in the form of departmental "priorities." The Director, as the committee's agent, administers this space; and he may reassign any unused area on a temporary basis. It is understood, however, that reassigned space will be returned to the department having priority over the area whenever it is needed. This system gives the Director essential flexibility, while assuring departments of continuing "first call" over their reasonable share of the facility. As necessary, the committee re-

views priorities to meet changing requirements.

The subject of design is considered elsewhere (see E. V. Barker, W. T. S. Thorp, this issue). However, the following categories of space are essential in a moden animal facility.

1. Project-specific animal areas
2. Species-specific animal areas
3. Animal isolation and quarantine areas
4. Specialized use areas: sterile surgery, x-ray, diet kitchen, animal treatment
5. General service areas: food, bedding, equipment storage; receiving and records; cage washing; equipment maintenance; waste disposal

Central administration is most acceptable when each investigator is assigned a separate area for his project reasonably close to his laboratory. To the greatest extent possible assignment of animals should be in rooms according to species and experimental groups; "Noah's Ark" accommodations should be discouraged. Not only does housing by species facilitate efficient servicing and care, it also aids in preventing the interspecies transmission of certain serious laboratory infections.

In planning animal quarters, therefore, it is ordinarily more desirable to divide an area into several medium-sized rooms which can be occupied individually than into one or two large rooms which must be shared. A possible exception to this principle is in the housing of dogs, which require more spacious accommodations than the smaller species. In a well planned facility the "chronic" dogs of several investigators or departments can be housed comfortably in groups of 30 or more, provided separate areas are made available for isolation, quarantine, and conditioning.

Provision of space adjacent to animal rooms for autopsy, inoculation, examination, and other "animal treatment" procedures adds greatly to the utility of central animal quarters. Depending on their specific use, such facilities may be shared or assigned to individuals. However, major experimental procedures are best performed in departmental laboratories which are not part of the central facility.

The pooling of resources in a central animal quarters makes possible substantial savings in space and equipment. For example, essential service areas and special use facilities, as outlined above, can be provide l without wasteful duplication. Such arrangements greatly increase the efficiency of the quarters and simplify their operation.

FINANCING THE ANIMAL SERVICE DEPARTMENT

Some investigators believe that individual or departmental quarters can be operated more economically than a central facility because the administrative overhead is less. Careful analysis of the financial records in several institutions fails to support this view (5). On the contrary, the over-all cost almost certainly is greater when each department operates its own facility. Common sources of unrealized expense to a department include the salaries of laboratory technicians and other personnel when they also care for animals; administrative time in procuring animals and supplies; and investigators' time in supervising the activity. In central quarters substantial savings are realized by volume purchase of food and supplies, and similar savings frequently are possible on animal purchases as well. Standardization of routine housing equipment also means lower equipment costs. Of great importance is the provision of labor-saving equipment such as cage washers and autoclaves which are financially beyond the individual departments.

The most common method of financing a central service is by recharging investigators for the care and maintenance of their animals. In effect this means the service is supported by those who use it. Assessments are made on a per diem basis, or as direct charges for materials and labor. The current per diem schedules of two representative medical schools are listed in Table 3. The charges apply to custodial care, including standard foods, bedding, cleaning supplies, administrative expenses, depreciation of

cages and equipment, and labor. However, the charge system, of necessity, must be sufficiently flexible to meet a variety of special care requirements. For example, both at N.Y.U. and U.C.L.A., charges are reduced if the investigator feeds his own animals; or an extra charge is made if the animal technician prepares a special diet.

The recharge structure promotes high operating efficiency, because it is subject to review and approval by the Animal Care Committee, and the service must pay its own way. This approach does not mean the sacrifice of quality for economy in animal care. It does mean, however, that the service unit must keep careful records, utilize personnel efficiently, eliminate wasteful practices, and invest intelligently in labor-saving equipment. For the investigator the recharge system has the advantage of keeping him continually aware of his animal census. It stimulates him to maintain only those animals actually needed, which procedure in turn increases the space for research.

A pertinent question is the extent to which a central service should receive a direct support "subsidy." In some institutions the entire cost of the animal service, including the Director's salary and related expenses, is recharged.[2] In other institutions the Director's salary is supported as for any other faculty member.[3] From the administrative viewpoint, the "user pays" principle would seem to be paramount. However, it should not be overlooked that a central service, through the Director, has specific and important educational functions. These "non-service" activities provide a basis for direct support which would seem to merit sympathetic consideration by institutional budget officers.

GRADUATE INSTRUCTION IN THE USE OF LABORATORY ANIMALS

The Director's academic activities customarily are carried on in one of the basic science departments, to which he should be appointed. In addition to consultation, an important teaching obligation is to offer instruction in the care and use of the laboratory species.

In most institutions graduate students in the medical sciences are expected to gain experience and perspective regarding animal experimentation "on-the job." However, their exposure to animals usually is limited to the species their advisors use, and in their courses to specific experimental techniques. There is little opportunity for broad orientation. In fact many students complete their graduate education with inadequate facility in the use of animals, and little insight into animal care problems.

TABLE 3

REPRESENTATIVE PER DIEM CHARGES FOR ANIMAL CARE

SPECIES	PER DIEM RATE U.C.L.A.	N.Y.U.
Dog	$0.51	$0.39
Monkey	0.51	0.39
Cat	0.33	0.24
Rabbit	0.135	0.11
Guinea Pig	0.085	0.07
Rat	0.021	0.021
Mouse	0.01	0.01
Hamster	0.021	0.021
Chicken	0.085	0.07

There is growing emphasis in all medical institutions on the scientific and ethical necessity for humane technique in the laboratory. This applies to the care of animals, their husbandry in the broadest sense, and to the techniques of experimentation itself (6). The Director has an important opportunity to advance graduate education in this area.

An example of a useful program is the course "Methods and Techniques in the Use of Laboratory Animals," offered in the Department of Physiology at the U.C.L.A. School of Medicine. It is designed to provide new graduate students in the basic medical sciences with suitable orientation. Audit by technical staff also is permitted. Students are introduced to the history of animal experimentation and to the husbandry require-

[2] Berg Institute, New York University.

[3] University of Illinois, Columbia University, U.C.L.A., Northwestern University, for example.

ments and characteristics of the laboratory species. Proper handling techniques, inoculation and drug administration procedures are demonstrated and practiced. Species suitability for particular types of research is discussed. Students become familiar with the growing literature on laboratory animal care (See Appendix). Faculty members, expert with particular species, are invited to participate in the weekly laboratory sessions. The utility of this course at U.C.L.A. suggests that similar programs would be of value in other institutions.

SUMMARY

At least 25 per cent of the medical schools in the United States now operate their animal quarters as an institutional "central service" under professional direction. This trend is due to the growing complexity of modern research institutions and to the evolution of laboratory animal care as a specialized discipline. The functions of a service department include routine and specialized animal care; procurement of animals; maintenance of breeding colonies; and ancillary functions such as cage washing and surgical services. The "Director" of the animal quarters has important educational as well as administrative obligations in training animal technicians, instructing graduate students in the methods and techniques of animal experimentation, consulting with faculty colleagues on animal care problems and, conducting research in his area of special interest. The success and acceptance of a unified operation depend on the extent to which the personnel meet the obligations of service. In a well run unit, personnel are well trained and dedicated. Under these conditions investigators receive the most equitable, efficient, and economical allocation of available services and facilities.

REFERENCES

1. Brochure, American Board of Laboratory Animal Medicine. Box. 299, Lemont, Illinois, 1957.
2. COHEN, B. J. The Anti-Science Menace—1957 Variety. Bull. Nat. Soc. M. Research, **12**:8, 1958.
3. ———. The Evolution of Laboratory Animal Medicine in the United States. J. Am. Vet. M. Assoc., **135**:(#2) 161–64, 1959.
4. MEYER, K. F. Introductory Address, 8th Annual Meeting Animal Care Panel. Proc. Animal Care Panel, **8**:1, 1958.
5. Personal communications, 1953–1959: C. A. Slanetz, Columbia University; N. R. Brewer, University of Chicago; N. S. Wolf, Northwestern University; A. L. Hesse, University of Illinois; and Unpublished reports of the Statewide Veterinarian, University of California.
6. RUSSELL, W. M. S., and BURCH, R. L. The Principles of Humane Experimental Technique, p. 6. London: Methuen & Co., Ltd., 1959.

APPENDIX I

SELECTED BIBLIOGRAPHY OF THE CARE, MANAGEMENT, AND USE OF LABORATORY ANIMALS

Periodicals

Proceedings of the Animal Care Panel (quarterly). Animal Care Panel, Box 299, Lemont, Illinois.

Journal of the Animal Technician's Association (quarterly). Laboratory Animals Centre, M.R.C. Laboratories, Woodmanstern Road, Carshalton, Surrey, England.

Bulletin for Medical Research of the National Society for Medical Research (bimonthly). 920 So. Michigan Blvd., Chicago, Illinois.

Information Reports and Newsletters of the Institute of Laboratory Animal Resources (monthly). 2101 Constitution Ave., N.W. Washington 25, D.C.

Carworth Farms, Quarterly Letters. Cumming C. N. W. Carworth Farms, New City (Rockland County), New York.

Laboratory Animals Bureau Collected Papers. Laboratory Animals Centre, M.R.C. Laboratories, Woodmanstern Road, Carshalton, Surrey, England.

Vol. I. Papers on Laboratory Animal Care and Use, 1953

Vol. II. The Design of Animal Houses, 1954

Vol. III. The Breeding of Laboratory Animals, 1955

Vol. IV. Infections in Laboratory Animals, 1956
Vol. V. Nutrition of Laboratory Animals, 1957
Vol. VI. Humane Technique in the Laboratory, 1957
Vol. VII. Administration of Animal Colonies, 1958
Vol. VIII. Quality in Laboratory Animals, 1959

Mouse News Letters (semi-annual). Collated by Lyon, M. F., Laboratory Animals Centre, M.R.C. Laboratories, Woodmanstern Road, Carshalton, Surrey, England (bibliographies and references to inbred mouse strains).

Bulletin of the Experimental Animals (bimonthly). Japan Experimental Animals Research Association. Tokyo (in Japanese).

Journal of Primatology (frequency unspecified). Japan Monkey Center, Institute of Primatology, Kurisu, Inuyama City. Aichi Pref. Japan (in Japanese with English summaries).

Comprehensive General References (More than One Species or Subject)

The Care and Management of Laboratory Animals. Worden, A. N., Lane-Petter, 2d. Ed., U.F.A.W., London, 1957.

The Care and Breeding of Laboratory Animals Farris, E. J. (ed.), John Wiley & Sons, New York, 1950.

Les Animaux de Laboratoire: Anatomie, Particularities Physiologiques Hematologie, Maladies Naturelles, Experimentation. Dumas, J. Editions Medicales Flammarion, Paris, 1953.

Animal Colony Maintenance. Farris, E. J., Carnochan, F. G., Cumming, C. N. W., Farber, S., Hartman, C. G., Hutt, F. B., Loosli, J. K., Mills, C. A., Ratcliffe, H. L. Ann. N.Y. Acad. Sc., **46**:1–126, 1945.

The Care of Laboratory Animals. *In:* Merck Veterinary Manual, p. 1231. Merck & Co., Rahway, New Jersey, 1955 (2d ed. in preparation).

Germ Free Vertebrates: Present Status. Reyniers, J. A., et al. Ann. N.Y. Acad. Sc., **78**: 1–400, 1959.

A Handbook of Laboratory Animals. National Academy of Sciences. National Research Council, Publication 317. Washington, D.C., 1954.

Animal Quarters for Teaching and Research. Special Issue. Journal of Medical Education (Papers on animal quarters design, management, training in animal care and animal diseases). In press, January, 1960.

Comprehensive References to a Particular Species

The Rat in Laboratory Investigation. 2d ed. Farris, E. J. and Griffith, J. G. (eds.). J. B. Lippincott & Co., Philadelphia, Pa., 1949.

Biology of the Laboratory Mouse. By the staff of the R. B. Jackson Memorial Laboratory. Snell, G. D. (ed.), 1941. Reprinted by Dover Publishing Co., N.Y., 1956.

Genetics of the Mouse. Gruneberg, H. The Hague, Netherlands: Martinus Nijhoff, 1952.

The Pigeon. 2d ed. Levi, W. M. Sumter, S.C.: Levi Publishing Co., 1957.

Rabbits. A Bibliography. Makepeace, L. I. Bibliographical Center for Research, Rocky Mountain Region, Denver, 1956.

The Dog in Medical Research. U.S. Dept. of Health Education and Welfare. Public Health Service Publication #312. 1953 (new ed. in preparation).

The Guinea Pig in Research. Biology, Nutrition, Physiology. Reid, M. E. Publication #557. Human Factors Research Bureau, Inc., Washington, D.C., 1958.

The Housing, Care and Surgical Handling of Laboratory Primates. Kennard, M. A., Ruch, T. C., Fulton, J. F. Yale J. Biol. & Med., **18**:443, 1946.

Oppossums as a Pediatric Research Tool. Dunham, E. C. A.M.A. J. Diseases of Children, **94**:372, 1957.

The Striped-Back or Chinese Hamster. *Cricetulus griseus*. Yerganian, G. J. Nat. Cancer Inst., **20**:705, 1958.

Diseases of Laboratory Animals

Canine Medicine. Hoskins, H. P., Lacroix, J. V., Mayer, K. (eds.). 2d ed. Santa Barbara, Calif.: American Veterinary Publications, Inc., 1959.

Pathologie der Laboratoriumstiere. Cohrs, P., Jaffe, R., Meessen, H. (2 vols.) West Berlin: Springer-Verlag. 1958.

Geschwülste der Laboratoriumstiere. Fischer, Von W., and Kühl, I. Obtainable from Intercontinental Medical Book Corp., 381 4th Ave., New York 16, N.Y.

Identification of Some Internal Parasites of Laboratory Animals. Habermann, R. T., Williams, F. P., Jr., and Thorp, W. T. S. Washington, D.C.: U.S. Dept. of Health, Education and Welfare USPHS Publ. #343, 1954.

Notes on Communicable Diseases of Laboratory Animals. Parish, H. J. E. & S. Livingston Ltd., Edinburgh, 1950.

Symposium on Some Infectious Diseases of Laboratory Rodents. Pappenheimer, A. M., Maurer, F. D., Saunders, L. Z., Cook, J. E., Nelson, J. B., Habermann, R. T., Williams, F. P., Griesemer, R. A., Yost, D. H., and Sokoloff, L. J. Nat. Cancer Inst., **20**:861, 1958.

Diseases of Laboratory Primates. Ruch, T. C. Philadelphia: W. B. Saunders Co., 1959.

A Bibliography of References to Diseases of Wild Mammals and Birds. Halloran, P. Am. J. Vet. Research, Vol. **16**, part 2, Oct., 1955.

Anatomy of Laboratory Animals

The Anatomy of the Rat. Greene, E. C. New York: Hafner Publishing Co., 1955.

Dissection Guides: I. The Frog; II. The Dogfish; III. The Rat with Notes on the Mouse; IV. The Rabbit. Rowett, H. G. Q. New York: Rinehart & Co., 1957.

Guide to the Dissection of the Dog. Miller, M. E. Ann Arbor: Edwards Bros., Inc., 1952.

Bensley's Practical Anatomy of the Rabbit. Craigie, E. H. 8th ed. Philadelphia: Blakiston Co., 1948.

Anatomy of the Cat. Reighard, J., and Jennings, H. S. 3d ed. New York: Henry Holt & Co., 1949.

An Atlas of Cat Anatomy. Field, H. E., and Taylor, M. E. Chicago: Univ. of Chicago Press, 1950.

The Anatomy of the Rhesus Monkey. Hartman, C. G., and Straus, W. L., Jr. Baltimore: Williams & Wilkins Co., 1933.

Laboratory Animal Surgery and Necropsy

Experimental Surgery, Markowitz, J. 3d ed. Baltimore: Williams & Wilkins, 1954.

An Introduction to Experimental Surgical Studies. Dempster, W. J. Oxford: Blackwell Scientific Publications, 1957.

Canine Surgery. Hoskins, J. P., Lacroix, J. V., Mayer, K. (eds.). 4th ed. Santa Barbara, Calif.: American Veterinary Publications, Inc., 1959.

Operative Surgery of the Dog. Miller, J. M., and Whitehorn, J. M. Special Ed. Veterinary Bulletin, American Cyanimid Co., Pearl River, N.Y., 1956.

Necropsy Procedure for Laboratory Animals. Olson, C. *In:* Veterinary Necropsy Procedures. Jones, T. C., and Gleiser, C. A. (eds.), Philadelphia: J. B. Lippincott, 1954.

Kind Killing. Vinter, F. J. 4th Ed. U.F.A.W. 7a Lamb's Conduit Passage, London, W.C. 1. 1957 (techniques of euthanasia).

Laboratory Animal Husbandry, Restraint and Related Problems

Care and Management of Laboratory Animals. Dept. of the Army and Air Force Technical Bulletin. TB Med. 255 AFP 160-12-3. Washington, D.C. 1958 (A manual for animal technicians).

Domestic Rabbit Production. Templeton, G. S. Interstate Publishers, Danville, Ill., 1955.

The Rabbit. Thompson, H. V., Worden, A. N. Collins, London, 1956.

Minimum Standards for the Commercial Production of Randombred and Inbred Laboratory Mice. Committee on Standards. Institute of Laboratory Animal Resources. J. Nat. Cancer Inst., **19**:1137, 1957.

Animals for Research. A Catalog of Commercial Sources. Institute of Laboratory Animal Resources (N.A.S.-N.R.C.) Washington, D.C., 1959.

Laboratory Animals Centre Technical Notes. 1953–1956. Laboratory Animals Centre. M.R.C. Laboratories Woodmanstern Road, Carshalton, Surrey, England.

Restraint of Animals. Leahy, J. R., and Barrow, P. 2d ed. Ithaca: Cornell Campus Store, Inc., 1953.

Diseases of and Methods for the Care, Inoculation and Bleeding of Animals. *In:* Approved Laboratory Technique. Kolmer, J. A., Spaulding, E. H., and Robinson, H. W. 5th ed., pp. 13–34. New York: Appleton-Century-Crofts, Inc., 1951.

Laboratory Animal Nutrition

Adequate Diets for Captive Wild Animals and Notes on Tuberculin Tests for Apes and Monkeys. Ratcliffe, H. L. Penrose Research Laboratory. Zoological Society of Philadelphia, 1956.

Rat Quality, a Consideration of Heredity Diet and Disease (Symposium Proceedings). Na-

tional Vitamin Foundation, Inc., 15 E. 58th St., New York 22, N.Y., 1953.

Standard Values in Nutrition and Metabolism. Albritton, E. C. (ed.). Philadelphia: W. B. Saunders Co., 1954.

Handbook for Prescription Diets. Morris, M. L. Animal Nutritional Research Service, 505 Mile High Center, Denver, Co. 1957 (prescription diets for dogs and cats).

Physiological Data

The Blood Picture of Normal Laboratory Animals. A Review of the Literature, 1936–46. Gardner, M. V. Biochemical Research Foundation. Newark, Delaware. Journal of the Franklin Institute, **243**:77, 1947.

Die Blutmorphologie der Laboratoriumstiere. Schermer, S. 2d Ed. Leipzig: Barth. 1958.

Handbook of Biological Data. Spector, W. S. (ed.). N.A.S.-N.R.C. Committee on Handbook of Biological Data. Philadelphia: W. B. Saunders Co., 1956.

Handbook of Toxicology. Vol. I. Ed. by Spector, W. S. N.A.S.-N.R.C. Committee on Handbook of Physiological Data. Philadelphia: W. B. Saunders Co., 1956. Vol. II. Antibiotics, 1957.

The Rabbit in Experimental Physiology. Kaplan, H. M. Scholar's Library, N.Y., 1956 (Student Laboratory Manual).

Manual for Laboratory Work in Mammalian Physiology. Rev. ed. D'Amour, F. E., and Blood, F. R. Chicago: Univ. of Chicago Press, 1954 (physiological experiments on the rat).

Construction of Animal Quarters and Cages

Qualitative Specifications for Animal Laboratories for Experimental Work with Radioactive Materials to Brookhaven National Laboratory. Report by Arthur D. Little, Inc., for U.S. Atomic Energy Commission, Oak Ridge: Technical Information Service, 1948.

Comfortable Quarters for Laboratory Animals. Animal Welfare Institute, 22 E. 17th St., New York, 1953.

Design and Construction of Metabolism Cages. Lazarow, A. *In:* Steele, J. M. (ed.), Methods in Medical Research. Vol. 6. Year Book Publishers, Inc., Chicago, Ill., 1954.

Protection of Medical Research, Animal Welfare, Antivivisection

Report of the National Conference on the Legal Environment of Medical Science. May 27–28, 1959. Sponsored by the National Society for Medical Research and the Univ. of Chicago, 920 S. Michigan Ave., Chicago, Ill.

The Principles of Humane Experimental Technique. Russell, W. M. S., and Burch, R. L. Methuen & Co., Ltd., London, 1959.

Notes on the Law Relating to Experiments on Animals in Great Britain. 2d Ed. Issued by Research Defense Society, 11 Chandos St. London, W. 1, 1959.

Conquest. Journal of the Research Defense Society (annual). 11 Chandos St., London, W. 1

Animal Welfare Institute. Information Reports (bimonthly), 22 E. 17th St., N.Y.

National Antivivisection Society Bulletin (bimonthly), 542 N. Dearborn St., Chicago, Ill.

Pamphlets and Bulletins for Animal Technicians

Care of Laboratory Animals. Slanetz, C. A. Subcommittee on Diagnostic Procedures and Reagents. American Public Health Assoc., 1790 Broadway, New York, 1954.

A Practical Guide on the Care of Small Animals for Medical Research. Herrlein, H. Rockland Farms, New City (Rockland County), New York, 1949.

Rabbits and Guinea Pigs. How To Raise Them Successfully. A. E. Staley Mfg. Co., Decatur, Ill., 1958.

Laboratory Animal Care and Feeding. Ralston Purina Co., St. Louis, Mo., 1957.

Basic Care of Experimental Animals. Animal Welfare Institute. 22 E. 17th St., New York, 1957.

The Problems of Disease and Quality in Laboratory Animals

JOHN B. NELSON, PH.D.
Laboratories of the Rockefeller Institute, New York, N.Y.

GENERAL ASPECTS OF NATURALLY ACQUIRED DISEASE

The adverse effect of naturally acquired disease is undoubtedly the most significant single factor in the rearing of laboratory animals and their use for experimental purposes. The geneticist may quarrel with this statement. The importance of selected and inbred strains is not questioned, but regardless of their hereditary background such strains are of little value if they are decimated by intercurrent disease. "Poorly kept animals or those which are already infected either with a latent or a chronic disease may, aside from the great loss entailed in the course of an experiment, furnish exceedingly unpleasant surprises and many misleading observations." This sentence was written by K. F. Meyer in 1928 and is an admirable summation of fact (16). In view of the unprecedented increase in the use of laboratory animals since the second World War, this statement is even more applicable now than it was at that time.

The problems of intercurrent disease are particularly important in dealing with small animals such as mice, rats, guinea pigs, and rabbits, which are raised under confinement in artificially maintained colonies. By reason of inactivity resulting from cage habitation and the lack of exposure to the hazards of a natural environment these animals have not undergone the rigorous selection of their field-raised counterparts. As a result, they are generally deficient in one or another of the factors which protect against infection.

There are many examples of the difference between field and colony-raised animals in their response to pathogenic agents. Native susceptibility is a determining factor, but the role of other influences as the comparative risk of exposure must also be considered. One illustration, from our records, concerns the incidence of otitis media and pneumonia in wild Norway and albino rats of comparable age (18). The respective rates are presented in Table 1. Involvement of the middle ear was determined by exposing the tympanic cavity and aspirating with a capillary pipette. Local inflammation was indicated by the removal of a purulent exudate.

Uniform susceptibility is usually an advantageous characteristic in experimental animals, and selective breeding is often practiced with this objective in view. The native levels of susceptibility may be altered by the inadvertent introduction of pathogenic agents. It is unfortunate that the methods of husbandry which are currently employed are in themselves conducive to the spread of infection. The practical necessity of holding large numbers of caged animals in a relatively small space for extended periods provides ample opportunity for the spread of pathogens by indirect contact. The confinement of several breeders with their nursing young in individual cages and the subsequent mixing of weaned young from many litters extend the risk through transmission by direct contact. The direct transfer of pathogens from an infected mother to her young during the nursing period is of par-

ticular significance in the maintenance of chronic infections.

In a discussion of laboratory animals the question of definition always arises. Any animal used for experimental purposes may be so defined. In the UFAW Handbook on the Care and Management of Laboratory Animals (British) more than 50 species, including domestic animals, some cold-blooded ones, and some invertebrates are listed (33). More often the list is restricted to small animals which are raised in colonies. In 1958 a survey of the commercial production in the United States of six commonly used laboratory animals was made by the Institute of Laboratory Animal Resources of the National Research Council (10). The total figure for the fiscal year was 17,075,629. The percentage distribution by species was as follows: mice, 71.41; rats, 23.03; guinea pigs, 2.51; hamsters, 1.62; rabbits, 1.4; and ferrets, 0.04. The figure for mice was approximately 12 million. It is probable that the over-all figure, including the number of mice used in laboratories that maintain their own breeding colonies, is closer to 15 million. Two decades ago these numbers would have bordered on the fantastic. The marked rise in the use of laboratory animals has brought with it a corresponding increase in the risk of infection and the problems of intercurrent disease.

Today, the commercially reared mice, which far outnumber all other laboratory animals, are raised on farms which may market up to 35,000 animals per week. By way of contrast, the origin of the random-bred Princeton strain, at least as a laboratory animal, may be cited. This mouse colony was established in 1922 at the former department of animal pathology of the Rockefeller Institute in Princeton, N.J. A few breeders were obtained from an elderly lady who fancied mice and kept them in boxes distributed about her home. The actual relation of this strain to other albino mice is unknown. The colony has been maintained from that time to the present with no admixture of mice from any other source. The Princeton mouse has a number of unique characteristics and has proved to be a very useful experimental animal. This humble origin is not peculiar to it but seems to be characteristic of random-bred mice in general.

EXAMPLES OF NATURALLY ACQUIRED DISEASE

It is not the purpose of this paper to catalogue either the native diseases or the disease agents of laboratory animals. The many related areas which must be considered for each species, namely: bacteria, viruses, protozoa, ectoparasites, endoparasites, metabolic disorders, congenital defects, and tumors are obviously beyond the capacity of any one person. A few examples of disease in a number of small animals will be cited. This partial listing will be followed by a more detailed consideration of rats and mice which have been studied in our laboratory for many years.

There is a marked difference among species in the number and kind of diseases to which they are naturally subject. The mouse unquestionably heads the list and is nearly the equal of man in the variety of its disorders and abnormalities. The hamster appears to be the least affected. Between the two extremes is the following group of animals, each of which has one or more dis-

TABLE 1

THE INCIDENCE OF OTITIS MEDIA AND PNEUMONIA IN WILD NORWAY AND ALBINO RATS

Type of rat	No. rats	No. with otitis media	Per cent incidence	No. with pneumonia	Per cent incidence
Adult Norway	58	1	1.7	6	10.3
Adult albino	75	52	69.3	61	81.3

tinctive diseases of importance in its maintenance and use.

The rabbit.—Snuffles, coccidiosis, and mucocid enteritis are widely distributed and particularly troublesome. Snuffles characterized by pneumonia, otitis media, and rhinitis is presumably of bacterial origin and caused by either *Pasteurella lepiseptica* or *Brucella bronchiseptica*. Several species of the protozoon *Eimeria* are common to the rabbit and affect either the intestinal tract or the liver. Mucocid enteritis, of unknown etiology, is found in rabbits of all ages but results in the highest mortality in young animals. The rabbit appears to be the only small animal with a true venereal disease, rabbit syphilis caused by *Treponema cuniculi*. An organism classified as a protozoon *Encephalitizoon cuniculi* is found in the brain and kidney, resulting in encephalitis and nephritis.

The guinea pig.—Lymphadenitis caused by a streptococcus which produces purulent swelling of lymph nodes is a common disorder. Several types of pneumonia, acute and chronic are also prevalent. One of Theobald Smith's numerous studies on native disease in laboratory animals was concerned with pneumonia in the guinea pig (27). This paper, published in 1913, dealt with the role of the organism then termed *Bacillus bronchisepticus* and the pneumococcus and may now be regarded as a classic. The disease was described as essentially a nonconfluent focal pneumonia, the bronchioles and the surrounding alveoli containing dense masses of necrotic cells. Marked fatty degeneration of the lungs and liver was also observed and believed at first to be part of the pneumonic infection. It was later found to be an independent condition but often associated with the bacterial induced lesions. Both conditions were limited to the winter season.

One hypothesis related the fatty changes to the type of food used during the winter months and extended observations previously reported by Smith in 1895 (28). He had noted that guinea pigs fed a diet of cereals as bran and oats in the absence of grass or a succulent vegetable developed a peculiar disease recognized by subcutaneous extravasation of blood. The affected animals showed swollen joints, subcutaneous and submucous hemorrhages, and died within 4–8 weeks. The disease could be controlled by the addition of a green vegetable to the diet. These were the earliest observations on scurvy in a laboratory animal, now well recognized as a vitamin deficiency of the guinea pig, resulting from the absence of ascorbic acid.

Otitis media, apparently of bacterial origin, is enzootic in some colonies. This condition has been troublesome in the use of guinea pigs for studies on the anatomy and physiology of hearing. Salivary gland disease is a fairly common disorder and has been of interest in the field of virology. Toxemia of pregnancy is responsible for a considerable number of fatalities in some breeding stocks.

The monkey.—Tuberculosis caused by human and bovine types of the tubercle bacillus and other forms of pulmonary disease may occur in acute or chronic form. Intestinal disorders with resultant diarrhea are particularly common. Bacteria of the *Salmonella* and *Shigella* groups are associated.

The dog.—Three diseases of viral etiology, namely: hepatitis, distemper, and rabies are of particular importance. A leptospirosis is also encountered.

The cat.—Infectious panleukopenia and pneumonitis, both of virus etiology, are widely distributed and important diseases. One of the cat tapeworms *Taenia taeniaformis* is often troublesome in the maintenance of rats and mice, which act as intermediate hosts. Ova are transported by shavings, cracked corn, and green food contaminated with feline droppings. On ingestion, the cysticercal stage develops and becomes encysted in the liver. Large nodules result and if multiple may cover much of the hepatic surface.

The ferret.—The most important disease is distemper which is acquired naturally or experimentally from the dog. The ferret is

an example of an animal which is highly susceptible to a disease native to another species. Dog distemper was studied in the ferret by Dunkin and Laidlaw (6) The results of their work were reported in 1925 in an important paper. The disease could be passed from dog to ferret and from ferret to dog at will. The ferret was so susceptible and the disease so severe that the introduction of infection into a breeding establishment readily resulted in the loss of the entire stock. The causal virus was readily transmitted by direct contact and was also seemingly air-borne over short distances. In the ferret the disease was manifested after an incubation period of about 10 days by conjunctivitis, coryza, vesicles and pustules in the skin, and occasionally by encephalitis. The mortality rate was at least 90 per cent, and death often occurred on the 5th day of the disease. A few animals recovered and were immune to reinfection.

These examples, though far from inclusive, serve to indicate the wide range of the diseases which affect laboratory animals. The only malady which may occur in all the above mentioned animals, in addition to rats and mice, and which indeed is well nigh universal in its distribution is Salmonellosis. *Salmonella typhimurium* (*B. aertrycke*) and *Salmonella enteritidis* are the two species most commonly encountered. Epizootics with variable mortality may occur, but more often the organisms are enzootic. They reside in the intestinal tract without producing any pathogenic effect unless they are activated by the stress of irradiation, cortisone, tumor growth or other factors. Focal involvement of the liver, spleen, and intestinal lymph nodes is a characteristic feature of the active disease. It may be noted that the colony of Princeton mice has now been maintained for some 30 years with no disturbances resulting from Salmonellosis.

The rat.—Chronic involvement of the respiratory tract is one of the commonest and most annoying of the diseases which affect both rats and mice. The chief manifestations of this disease, namely: rhinitis, otitis media, labyrinthitis, and pneumonia had long been recognized in the rat and regarded as manifestations of a single disease entity. The pneumonic reaction beginning with inflammation and plugging of the bronchi progresses slowly and leads to abscess formation with multiple nodules and cavitation. In some instances, however, resolution occurs with atrophy and fibrosis. The chronic pulmonary state has variously been termed lung abscess, nodular disease of the lung, endemic pneumonia, but more commonly rodent bronchiectasis by reason of a superficial resemblance to the latter condition in man. It is largely a disease of mature animals and may attain a high incidence in albinos, as indicated in Table 1. The rate of pneumonia in 70 young albino rats, also examined at that time, was 2.8 per cent as compared with 81.3 per cent in adults. It was significant that the rate of otitis media in the young rats was 32.8 per cent, though its importance was not then realized. The pneumonia is well tolerated and may involve three or more of the five lobes of the lung with little adverse effect. Deaths occur but are usually sporadic.

Studies on chronic respiratory disease of the rat were begun in our laboratory in 1928 and have been continued to the present (9). Although the disease was well known, as indicated, its etiology was undetermined. Our earlier work had tended to incriminate *Streptobacillus moniliformis* as the causal agent. An attempt with Gowen to develop an infection-free colony by the successive selection of young breeders with normal lungs and middle ears met with failure (20). Pneumonia ultimately reappeared, but two significant facts were established. Absence of the streptobacillus from the pneumonic lungs of older rats from the selected colony eliminated that organism as the etiological factor. Freedom of these rats from middle ear involvement indicated that otitis media was not a sequela of the bronchiectatic type of pneumonia. The pneumonia was often accompanied, however, by rhinitis.

The pulmonary reaction was later found to be reproducible in Princeton mice, known

to be free from respiratory disease, by nasal instillation. A virus was established as the causal agent. In the rat the virus was transmitted from infected mothers to their young during the nursing period but was not demonstrable in them at birth. In the mouse the pneumonic reaction was accelerated, and lung lesions were commonly observed by the 4th week after nasal instillation. In contrast to the disease in the rat the middle ears were also involved.

Meanwhile, evidence was obtained that otitis media in the rat was a manifestation of infection with a pleuropneumonia-like organism (PPLO). This disease, termed infectious catarrh, occurred in young rats as well as in older animals. Pneumonia was sometimes observed, but otitis media and rhinitis were the chief sequelae (21). The two diseases, one caused by a virus and the other by PPLO, were not infrequently superimposed in the same animal. Together, they accounted for the chronic respiratory syndrome which occurred so frequently in adult rats.

In 1949 a different virus was obtained from the pathologic lungs of two wild rats (22). On nasal instillation in Princeton mice it produced an acute respiratory disease with high mortality. It was also transmissible, though less regularly, by direct contact. The experimental disease was characterized by interstitial pneumonia with marked pulmonary edema and occasionally by otitis media. On nasal injection in albino rats a similar but less acute pneumonic reaction resulted. Natural infection also occurred in albino rats but in our experience was uncommon. Some twelve isolations of the virus were made in our laboratory over a period of years. In some rats it co-existed in the lung with either PPLO or the virus of enzootic bronchiectasis. The wild rat pneumonia agent was very similar to the grey lung virus of mice described by Andrewes and Glover in 1945 (1).

Pneumonia may also result, in laboratory rats, from infection with a number of conventional bacteria, notably: *Brucella bronchiseptica*, pneumococci, corynebacteria, and *Pasteurella*. These diseases are commonly acute and may run an epizootic course with a variable death rate. The respective bacteria are readily identified by appropriate cultural methods.

The mouse.—Diseases of the respiratory tract are frequently encountered in mice and are very similar to those of the rat. The same species of causal bacteria occur in both rodents, and two of the viruses are closely related if not identical. Latent viruses of the type described by Horsfall and Hahn in 1939 seem, however, to be carried more often by mice than rats (11). A frank pneumonia may be demonstrable only on continued nasal passage. K virus reported in 1952 by Kilham is of particular interest, because it was initially recovered only from adult mice (C3H) carrying the Bittner milk factor and was active only in young nurslings (12). On injection, it produced a fatal pneumonitis characterized by swelling of the endothelial cells lining the pulmonary blood vessels and the presence of intranuclear inclusions.

Particular attention has been paid in our laboratory to the chronic respiratory infections of the mouse. As in the rat, there are two principle types, one caused by a virus and the other by PPLO. Both agents may be interchangeable between the two rodents and are similarly transmitted. Aside from the production of otitis media by the virus in the mouse and its accelerated reaction in the lung, the description of these diseases in one species applies equally well to the other. It should be noted, however, that mice infected with either agent tend to chatter or chuckle, whereas the rat snuffles.

For some years we have followed the course of chronic pneumonia in a breeding colony of Swiss mice. The morbidity rate has steadily increased and is now so high, even in weanlings, that the mice are largely useless for experimental purposes. The death rate is relatively low, and aside from chattering many of the infected animals show no external signs of illness. If adults are killed and autopsied, one or more lobes of the lung is found to be completely con-

solidated. The comparative incidence of pneumonia in discarded Swiss and Princeton breeders is shown in Table 2.

The pneumonia of Swiss mice is readily reproduced in Princeton weanlings by the nasal instillation of suspensions prepared from lungs with consolidated lobes. The injected mice commonly show both pneumonia and otitis media when brought to autopsy during the 4th week. The absence of PPLO from cultures of middle ear exudate and of lung suspensions provides strong presumptive evidence that the causal agent of the disease is a virus. If the injected mice are held beyond the 4th week, sporadic deaths occur over an extended period.

During recent years, a group of murine viruses of unique nature has come into being. These agents produce degenerative changes in the liver, a condition which has come to be called, somewhat incorrectly, murine hepatitis. Several members of the group also cause encephalitis with paralysis of the hind legs. This family of viruses was termed the hepato-encephalitis group by Morris and Aulisio (17). These viruses have been recovered from a number of different mouse strains and display considerable strain specificity. Under natural conditions, they appear to exist in an inactive or undeveloped state and are usually demonstrable only when some form of stress is applied to the host.

Our work with the murine hepatitis viruses began in 1952 with ones that appeared in Princeton weanlings during the intraperitoneal passage of lymphocytic leukemia (23). During the 12th passage of the tumor in Princeton weanlings, areas of focal necrosis suddenly developed in the livers of the injected animals. A total of 55 mice had been used in the preceeding passages. A virus which bore no relation to the leukemia was recovered from the involved livers. It was readily transmissible in young weaned mice of the same strain by the injection of cell-free liver suspensions and was highly virulent. The injected mice usually died on the 2d or 3d day and showed diffuse necrosis of the liver. The mortality rate was close to 100 per cent. The virus produced little or no reaction in the livers of Swiss weanlings on initial injection but on continued passage became adapted and acquired pathogenicity.

While our work was in progress another type of murine hepatitis virus was reported in England by Gledhill and Andrewes (9). Their later studies, with Dick and Niven, brought to light an interesting example of microbial synergism (26). The intraperitoneal injection of Webster's BSVS weanlings with fresh organ suspensions from mice of the Park's strain resulted in a syndrome similar to the hepatitis of Princeton mice. It shortly became apparent that two components were present in the suspensions, both of them filtrable and noncultivable. One component, resistant to terramycin, was identified as a virus of such low virulence that it produced little or no liver reaction, on injection. The second component, sensitive to terramycin and also largely inactive, was shown to be the murine parasite of the blood *Eperythrozoon coccoides*. Injection of the two components together resulted in highly fatal hepatitis, preceded by a marked increase of the eperythrozoa in the circulating blood.

E. coccoides is related to *Haemobartonella muris*, which causes anemia in splenectomized rats. It is not present in Princeton mice

TABLE 2

THE INCIDENCE OF PNEUMONIA IN ADULT SWISS AND PRINCETON MICE

Strain	Age (months)	No. mice examined	No. with pneumonia	Per cent incidence
Swiss	8–10	60	43	71
Princeton	10–12	75	0	0

but may be carried by other strains, notably BALB/c. This organism has been maintained in our laboratory since 1953. Intraperitoneal injection of heparinized heart's blood is made in unsplenectomized Princeton mice at intervals of 2–4 weeks. The chracteristic disks and rings of *E. coccoides* are regularly demonstrable in Giemsa-stained films of tail blood removed on the 3d day after injection. The mice survive and are not noticeably affected, but may show some splenic enlargement when killed and autopsied.

The laboratory mouse is subject to numerous additional diseases and abnormalities; some are microbial in origin, others of unknown etiology. The latter group includes hydronephrosis, hydrocephalus, overgrowth of the incisors, sloughing of the toes and legs, and so-called ring tail disease. This condition is characterized by concentric constrictions of the tail, accompanied by digital swelling. Many different neoplasms have been described. Some of them, such as tumors of the mammary and salivary glands and certain of the leukemias, are presumably of viral etiology (Gross, Friend, and Stewart—reviewed by Dmochowski [5]). The term "polyoma virus" has recently been introduced to designate a filtrable agent able to promote tumor growth of unrelated cell types. In unselected and random-bred mice, tumors are usually limited to adult animals, and the morbidity rate is low. The incidence of lymphocytic leukemia in year-old breeders of the Princeton strain is about 5 per cent, whereas that of mammary carcinoma and lung adenoma is less than 1 per cent.

Microbial diseases are particularly numerous, and only a few can be listed. Corynebacteria are sometimes troublesome. They normally reside in the nasal passages, with no untoward effect; but if carried inwardly they may cause an acute pneumonia, septicemia, cervical lymphadenitis, and focal necrosis of the liver. Pneumonia and lymph node involvement are also caused by streptococci. An outbreak of cervical lymphadenitis studied in our laboratory was attributed to hemolytic streptococci of the human type (24). Joint lesions may result from infection with *Streptobacillus moniliformis*. Tyzzer's *B. piliformis*, which has resisted cultivation, is occasionally associated with focal necrosis of the liver. *Pseudomonas pyocyaneus* has come to be a problem in both mice and rats. It is an actively motile bacillus, highly resistant to antibiotics, which normally resides in the intestinal tract and the nasal passages with no ill effects. Under continued stress it may appear in the blood stream and result in death.

The following viral diseases are important and demand more than passing attention.

Ectromelia (mouse pox).—This disease, first described by Marcal in 1930, is highly communicable and the most lethal one of mice (15). Epizootics occur and may result in a mortality rate of 60 per cent or more during a brief period. The virus may also be carried in a latent state. The studies of Fenner in Australia and of Briody in the United States are outstanding (2, 7). Ectromelia is manifested by a variety of pathologic changes which may mimic those of other diseases. Necrotic lesions, characteristic of the pox viruses, occur in the skin, liver, and spleen, and acidophilic inclusions are found in the cytoplasm of epithelial cells. The disease was seemingly first introduced into this country in 1950 through the careless handling of an imported strain of the virus. Christensen has recently studied a number of sporadic outbreaks which occurred in mice given injections of tumor suspensions (4). These differed from the usual epizootics in that clinical signs were usually missing, and transmission to other animals in the colony did not occur. A latent virus was presumably picked up by the neoplastic cells, which acted either as a preferential medium or exerted an activating stimulus. In any event, a virulent virus was subsequently maintained by transfer of the tumors.

Lymphocytic choriomeningitis.—The virus of this disease was first described in mice by Traub in 1935 (31). It generally exists in a latent state. Infected animals are often

normal in appearance, but clinical signs such as drowsiness, emaciation, and conjunctivitis may occur. In one group studied by Traub, about half of the animals were infected. The mobidity rate was 20 per cent and the mortality rate 2 per cent. The virus was demonstrable in the blood, brain, urine, and nasal secretions. Transmission was presumably by contact. Nervous symptoms, characterized by convulsions and paralysis of the hind legs, usually occurred only after intracerebral injection. Visceral lesions, notably of the liver, were attendant on intraperitoneal injection. The virus of this disease is one of few murine pathogens which may also be transmitted to man.

Encephalomyelitis (mouse polio).—The first report of this disease was by Theiler in 1934 (29). Paralysis of the hind legs is the most characteristic feature but is rarely seen in naturally infected mice. The causal virus is widely distributed but is usually found only in the intestinal tract and feces. A single case of paralysis was observed by Theiler in 1000 mice, although the virus was recovered from the intestines of about 60 per cent through the 6th month. It has not been isolated with certainty from mice of the Princeton strain. Pathologic changes are largely limited to the brain and cord, which show destruction of the nerve cells. The nervous symptoms are readily reproduced in weanlings by intracerebral injection. Several different types of the virus are recognized. The disease is of interest by reason of its general resemblance to poliomyelitis in man.

Epizootic diarrhea of infant mice.—This disease is widely spread in nature and may be highly destructive in breeding colonies. The independent observations of Cheever and Kraft indicate that it is communicable and caused by a virus (3 and 13). The disease is limited to nurslings and usually occurs between the 9th and the 16th day of life. Epizootics may continue for a considerable period and result in a mortality rate as high as 80 per cent. The virus may also exist in an enzootic state. Kraft notes that clinical signs vary from slight and brief rectal soilage to almost complete coverage with a tenacious, mucoid, and mustard-colored fecal matter. The rectum may be impacted. At autopsy, the lower colonic contents are fluid and yellow or gray-green. Epithelial inclusions have been observed, but their relation to the disease is uncertain. Cheever's observations indicate that 1st litters show a poorer chance of survival than do subsequent ones. Breeders nursing diarrheal young may acquire the virus but show no clinical signs. Kraft regards airborne carriage as the most probable route of communication but is unable to account for the appearance of diarrhea in a previously non-diarrheal colony. Is it possible that breeders continue to carry the virus in an inactive or undeveloped state as they seemingly do in murine hepatitis?

THE CONSEQUENCES OF NATURALLY ACQUIRED DISEASE AND MEANS OF CONTROL

The preceding examples are sufficiently varied to emphasize the complexity of the problems arising from naturally acquired disease in laboratory animals. Diseases which reduce the number of available animals either directly through death or indirectly by adverse effects on the size and number of litters are particularly important in breeding colonies. Ectromelia and infant diarrhea in mice, mucoid enteritis in rabbits, and toxemia of preganancy in guinea pigs are illustrative of such conditions. Chronic infections and inapparent or latent ones are especially troublesome in the experimental use of animals.

The introduction of an experimental agent, either microbial or chemical, into an animal already infected with a pathogen, is much like the transfer of an isolated bacterium to a medium which is contaminated. In both cases, erroneous conclusions may be expected. It is true that pure cultures do not exist in nature but in studying the properties of an unknown it is desirable that contamination be reduced to a minimum. Interference of one form or another may occur if pathologic test material is injected intra-

nasally in mice infected with the virus of chronic pneumonia. Unawareness of the natural disease would result in attributing the pulmonary reaction to the material under test. The intraperitoneal passage of tumors and other cell suspensions in mice, a common practice, may result in the emergence of hepatitis virus with adverse effects. The presence of *E. coccoides* is also a hazard. A sharp line cannot be drawn between breeding and use, however, with respect to the impact of native disease, since the two are closely interrelated.

The animal itself is usually the most important source of infection, through carriers of either active or latent agents, and direct contact is the most effective means of transmission. Many other factors, however, may play a role in pathogenesis and communicability. Air-borne infection, carriage by ectoparasites and insects, contact with contaminated bedding, food, and water, contact with wild rodents, and carriage by attendants may be important in the transfer of one or another disease. Other factors which must be considered are fluctuations in temperature and humidity, exposure to drafts, deficient lighting, overcrowding, and careless handling. Small animals are particularly sensitive to their environment and adversely affected by neglect.

The ideal experimental animal, whatever the species, would be strictly disease-free. In all likelihood this ideal will never be realized. Little can be done, at present, in preventing pathologic conditions of unknown etiology, such as mucoid enteritis of the rabbit. Pathogenic agents which are inapparent under normal conditions, e.g., the viruses of the murine hepatitis group, are not now subject to any control. Future work, extending our present knowledge, may provide effective methods of eradication. Meanwhile, however, much can be accomplished in the elimination of communicable diseases caused by agents which can be identified and which do not pass the placental barrier or appear in the mother's milk.

With recognition of the difficulties inherent in disease control the term "specific pathogen-free" (SPF) was introduced several years ago in the United States. This term has unjustly been criticized as meaningless. It signifies only that an attempt has been made to eliminate certain specified pathogens from a particular animal colony. A start has indeed been made with rats and mice, and regulations have been proposed for accrediting disease-free animals. The larger dealers are now aware that the development of SPF colonies is to their advantage, and some of them have taken commendable steps toward its accomplishment. It is an odd commentary that opposition has been encountered on the part of the user, fear being expressed that earlier results would not be reproducible with the selected animals.

There is no easy or certain way of eliminating disease from an infected colony. We have had some measure of success with rats and mice by using infection-free foster mothers. The young of infected breeders were removed by cesarean section and reared in strict quarantine by nursing females from another colony. The conjunctival type of PPLO was eradicated from Princeton mice in this way (25). Infant rats removed by cesarean section and hand fed at the Lobund Institute of Notre Dame were successfully used in our laboratory for establishing a rat colony free from chronic respiratory disease (19). These animals were not germ-free. Breeders from this small group were later used as foster mothers at a commercial rat farm for rearing cesarean-removed young. Both respiratory infections were apparently brought under control, but infectious catarrh was later reintroduced.

Theiler in 1941 was able to develop a colony of mice free from the virus of encephalomyelitis by using albino rats as foster mothers for 2–3-day-old nursling mice (30). This method has the disadvantage of introducing the agents of chronic respiratory disease unless infection-free rats are employed.

The above method of breaking the contact between an infected mother and her young is based on the assumption that the

infective agent does not pass the placental barrier. In rats and mice a single layer of cells is interposed between the maternal and the fetal circulation. It is probable that most bacteria and viruses do not penetrate this barrier. Theiler had found that the virus of mouse encephalomyelitis, which is about 10 mμ in diameter and probably the smallest one carried by mice, is not present at birth. Size is not the only factor, in this connection, and there is reason to believe that the larger murine hepatitis viruses may pass from an infected mother to her young during intrauterine life.

Germ-free rats and mice from the Lobund Institute have recently become available for use as foster mothers. Although favorable results have been reported with these animals, their status in regard to the carriage of viruses is uncertain. Ward has described a pneumonic reaction with consolidation which began with the 5th passage of a lung suspension in germ-free rats (32). By the 10th passage at least half of the total area of the lung was involved. The etiology of this condition was uncertain, but a virus was favored as the causal agent. Additional work with germ-free animals in regard to the presence or absence of viruses is required before they can be accepted without reservation.

The establishment of a mouse colony free from infant diarrhea has recently been reported by Kraft (14). The essential feature was the prevention of contact with dust particles, by air filtration. Cages enclosed in Fiberglas and a special bacteriological hood were employed in the maintenance of the animals.

Other methods include the selection of breeders with high natural resistance, vaccination, and the use of chemotherapeutic agents. In general, these methods are more suited to the control of pathogens than their elimination. The use of drugs has proved to be valuable, however, in the eradication of rabbit syphilis (arsenicals), ectoparasites (Aramite with Nacconal) and the pin worms (piperazine hexahydrate) of rodents.

The maintenance of colonies in a SPF state is fully as important as their establishment and nearly as difficult to achieve. In general, these animals are highly susceptible and must be held in quarters with strict sanitary precautions. It is essential that sufficient barriers be erected to prevent the reintroduction of infection from an outside source. Controlled temperature and humidity are desirable. The health of the attendants is a problem to be considered. Care should also be exercised in the experimental use of SPF animals. Practices which have often been followed in the past: such as the interchange of water bottles, overcrowding within cages, and the mixing of animals of different species and from different sources in the same room must be discontinued. The custom of regarding any experimental animal that lives as a normal animal should also be avoided. Too little attention is paid to post-mortem examination. Morbidity is fully as important as mortality and often can be detected only at autopsy. If a breeding colony is maintained, valuable information can be obtained by the periodic autopsy of discontinued breeders.

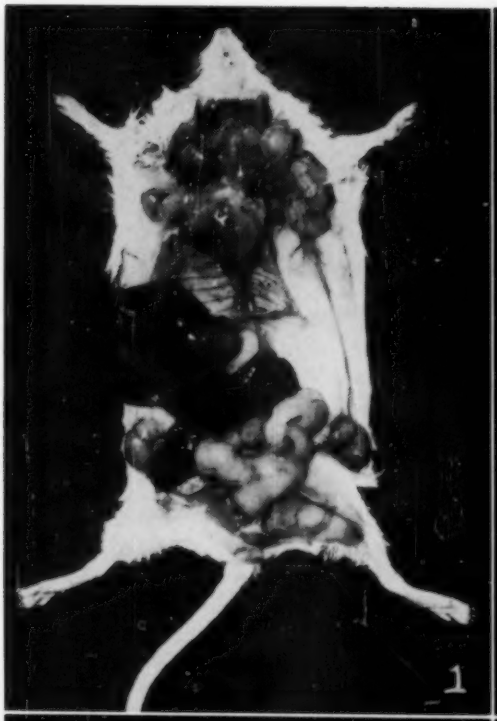
The study of naturally acquired disease in laboratory animals is not merely a means for providing better subjects for experimental use but is an integral branch of pathology and a highly fascinating one. Failure to recognize its significance is both unprofitable and unscientific.

REFERENCES

1. ANDREWES, C. H., and GLOVER, R. W. Grey Lung Virus: an Agent Pathogenic for Mice and Other Rodents. Brit. J. Exper. Path., **26**:379, 1945.
2. BRIODY, B. A. Mouse Pox (Ectromelia) in the United States. Proc. Animal Care Panel, **6**:1, 1955.
3. CHEEVER, F. S. Diarrheal Disease of Suckling Mice. Ann. N.Y. Acad. Sc., **66**:196, 1956.
4. CHRISTENSEN, L. R. (personal communication).
5. DMOCHOWSKI, L. Viruses and Tumors. Bact. Rev. **23**:18, 1959.
6. DUNKIN, G. W., and LAIDLAW, P. P. Studies in Dog Distemper. 1. Dog Distem-

per in the Ferret: J. Comp. Path. & Therap., **39**:201, 1926.

7. FENNER, F. Mouse-pox (Infectious Ectromelia of Mice): A Review. J. Immunol., **63**:341, 1949.
8. FLYNN, R. J. Ectoparasites of Mice. Proc. Animal Care Panel, **6**:75, 1955.
9. GLEDHILL, A. W., and ANDREWES, C. H. A Hepatitis Virus of Mice. Brit. J. Exp. Path., **32**:559, 1951.
10. HILL, B. F. American Commercial Laboratory Animal Production. Monthly Report, Inst. of Lab. Animal Resources, Nat. Res. Council, **2**:1, 1959.
11. HORSFALL, F. L., and HAHN, R. G. A Pneumonia Virus of Swiss Mice. Proc. Soc. Exper. Biol. & Med., **40**:684, 1939.
12. KILHAM, L. Isolation in Suckling Mice of a Virus from C3H Mice Harboring the Bittner Milk Agent. Science, **116**:390, 1952.
13. KRAFT, L. M. Studies on the Etiology and Transmission of Epidemic Diarrhea of Infant Mice. J. Exper. Med., **106**:743, 1957.
14. ———. Observations on the Control and Natural History of Epidemic Diarrhea of Infant Mice. Yale J. Biol. & Med., **31**:121, 1958.
15. MARCAL, J. Infectious Ectromelia. A Hitherto Undescribed Virus Disease of Mice. J. Path. & Bact., **33**:713, 1930.
16. MEYER, K. F. Communicable Diseases of Laboratory Animals. *In:* E. JORDAN and I. S. FALK, The Newer Knowledge of Bacteriology and Immunology, p. 607. Chicago: Univ. of Chicago Press, 1928.
17. MORRIS, J. A., and AULISIO, C. G. A New Member of the Hepato-Encephalitis Group of Murine Viruses (Abstract). Fed. Proc., **13**:506, 1954.
18. NELSON, J. B., and GOWEN, J. W. The Incidence of Middle Ear Infection and Pneumonia in Albino Rats at Different Ages. J. Inf. Dis., **46**:53, 1930.
19. NELSON, J. B. The Etiology and Control of Chronic Respiratory Disease in the Rat. Proc. Animal Care Panel, **7**:30, 1957.
20. NELSON, J. B., and GOWEN, J. W. The Establishment of an Albino Rat Colony Free from Middle Ear Disease. J. Exper. Med., **54**:629, 1931.
21. NELSON, J. B. Infection in Laboratory Animals with Pleuropneumonia-like Organisms. J. Nat. Cancer Inst., **20**:911, 1958.
22. ———. Observations on a Pneumotropic Virus Obtained from Wild Rats. 1. Transmission of the Agent to White Mice and Rats. J. Inf. Dis., **84**:21, 1949.
23. ———. Mouse Hepatitis in Relation to Leukemia. Bull. N.Y. Acad. Med., **33**:811, 1957.
24. ———. Association of Group A Streptococci with an Outbreak of Cervical Lymphademitis in Mice. Proc. Soc. Exper. Biol. & Med., **86**:542, 1954.
25. ———. The Relation of Pleuropneumonia-Like Organisms to the Conjunctival Changes Occurring in Mice of the Princeton Strain. J. Exper. Med., **92**:431, 1950.
26. NIVEN, J. S. F.; GLEDHILL, A. W.; DICK, G. W. A; and ANDREWS, C. H. Further Light on Mouse Hepatitis. Lancet, **2**:1061, 1952.
27. SMITH, T. Some Bacteriological and Environmental Factors in the Pneumonias of Lower Animals with Special Reference to the Guinea Pig. J. Med. Research, New Series, **24**:291, 1913.
28. ———. Swine Erysipelas or Mouse-Septicemia Bacilli from an Outbreak of Swine Disease. 12th and 13th Ann. Rep. Bureau of Animal Ind., p. 166, 1895–96, Washington, D.C.: Govt. Printing Office.
29. THEILER, M. Spontaneous Encephalomyelitis of Mice—A New Virus Disease. Science, **80**:122, 1934.
30. ———. Personal communication.
31. TRAUB, E. Choriomeningitis Virus. Science, **81**:298, 1935.
32. WARD, T. G. Pneumonia Virus of Rats. Annual Progress Report to Office of Naval Res., Lobund Inst., Univ. of Notre Dame, Ind., p. 65, 1958.
33. WARDEN, A. N., and LANE-PETTER, W. Handbook on the Care and Management of Laboratory Animals. London, England: Univ. Fed. Animal Welfare, 2d ed., 1957.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The preceding photographs of mice were selected from our collection as illustrative of the abnormalities that may appear in laboratory animals. (Photographed by Mr. J. A. Carlile.)

FIG. 1.—Lymphocytic leukemia in a year-old female breeder of the Princeton strain. All organs that were not involved have been removed.

FIG. 2.—Loss of limb with complete closure and healing, resulting from some cause other than trauma. This condition occurred in a group of mice under observation at the Sloan-Kettering Institute, New York, N.Y.

FIG. 3.—Ring-tail disease in a young adult of the Swiss strain.

FIG. 4.—Paralysis of the hind legs with backward extension, occasionally observed in murine hepatitis, encephalomyelitis, and lymphocytic choriomeningitis.

Training in Animal Care*

L. R. CHRISTENSEN, PH.D.†
New York University-Bellevue Medical Center
New York, N.Y.

We are presently undergoing a rapid change in our concepts of all phases of animal care and have begun to realize that the proper care of experimental animals is an essential and highly specialized aspect of research. Animal quarters must be designed for this specific purpose; strains with a specific genetic background or free of specific diseases are an absolute requirement for many experiments; and of equal importance are personnel with the special knowledge and training to adequately care for them. All these and many other factors must be considered in order to limit the variables in the experimental situation to those deliberately introduced by the investigator. That such factors as temperature, noise, cage size, or the personality of the caretaker can bias results obtained with experimental animals is beginning to be realized. For reasons not clear to me, we have unfortunately neglected this most crucial and critical research tool of our modern scientific age—the laboratory animal. In too many instances, the animal quarters are still the least desirable areas, often without proper facilities, and animals are purchased with no thought to the competence of the breeder, his facilities, or the quality of his stock. Under experiment, the animal is fed some diet hallowed by tradition, housed in inadequate cages inherited from some predecessor, and observed only as a living or dead statistical unit at the end of the experiment. If mortality in the group is "unusually high," or "unexpected," the experiment will frequently be repeated with no change other than in numbers or source of animals. In keeping with this indifference to the many factors important to the valid response of the animal under experiment, the animal caretaker has generally been selected from the ranks of unskilled laborers, qualified solely by his willingness to accept an inadequate wage, given little or no instruction in other than the mechanics of his job, and set to cleaning cages and providing food and water for his charges.

The increasing insistence upon improved biological quality and uniformity of response in experimental animals has resulted in the establishment of such highly specialized centers as the Jackson Memorial Laboratories for the production of inbred strains of mice, the Lobund Institute for the production of gnotobiotic and germ-free animals, and in the growth of commercial breeding establishments of a quality and quantity unmatched elsewhere in the world. In terms of number, quality, and variety, nowhere else in the world are laboratory animals as available as they are in the United States. This is not meant to imply a state of perfection here; quite the contrary is true, but other areas are much worse off.

* While the opinions expressed are those of the author, they are based on many discussions with members of the ILAR, the Animal Care Panel, and the Metropolitan New York Branch committees on caretaker education, and with many interested individuals here and abroad. Particular thanks are due to Dr. W. Lane-Petter and Mr. George Porter of the Laboratory Animals Centre, who arranged visits and discussions with members of the Animal Technicians Association and scientists on a recent visit to Great Britain.

† Associate Professor of Pathology; Director, Berg Institute.

With a few isolated exceptions, the physical facilities for animal care are unmatched elsewhere in the world. In the case of the animal caretaker, however, at least one country, Great Britain, has far outstripped us. As the result of a systematic education program which has been in effect for about 9 years, the British animal caretaker is definitely superior in competence, morale, interest, and adaptability to his counterpart here.

The education of those responsible for the breeding and care of laboratory animals, from the animal caretaker to the professional man directing a large research colony, is extremely important. The object of this education should not be the production of animal geneticists, animal nutritionists, or animal bacteriologists, important though these fields are in their own right. Rather, its function should be the abstraction from these and all other fields of biology, information and knowledge related to laboratory animal care, integration of this material and its presentation in a usable manner to those whose profession is the care of laboratory animals. Obviously, an animal caretaker cleaning cages and a veterinarian in charge of a large research colony can use a knowledge of bacteriology. Equally obvious, the information to be presented and manner of presentation will differ markedly for these two individuals. It is essential that each group be presented material at its proper level of understanding and need.

Education for animal care in England.— It is impossible to discuss or plan caretaker education without drawing heavily on British experience. The program in England apparently received its impetus during the war years when the difficulties of animal supply and care led to the spontaneous formation of a small committee of representatives from certain of the large chemical industries. In 1950 this committee recommended, among other things, the formation of an association of animal technicians[1, 2].

[1] J. R. M. Innes, Pathologist, Biochemistry Department, Brookhaven National Laboratories, personal communication.

This recommendation was presented to technicians attending the third Laboratory Animals Bureau Congress in London, with the result that the present Animal Technicians Association was formed. The objectives of the organization are:[3]

1. To spread knowledge of animal techniques and to raise the status of the Technician (animal caretaker).

2. The formation of local branches in the United Kingdom which will provide facilities for the presentation of scientific papers and allow discussion and exchange of ideas.

3. The publication of a quarterly journal.

4. To provide means for the education of members.

5. To conduct examinations of candidates.

6. To provide a register of positions available.

The Association certifies members in three grades of competence, following successful completion of an examination in each grade. The several levels as adopted last year[4] are:

1. Preliminary certificate. Successful completion of the preliminary examination, which is oral and practical. The candidate must be not less than 17 years of age (many animal caretakers start at 15) and have had at least 2 years experience.

2. Associateship certificate. At least 20 years of age, 2 years' experience in a recognized laboratory or animal house, and successful completion of the associateship examination. To qualify for the examination, the candidate must submit evidence of training in such subjects as physiology, nutrition, animal disease, and elementary animal house administration. The examination is written, oral, and practical.

3. Fellowship Diploma. This is the highest rank and is held by only a few who are,

[2] A. E. Mundy, The Animal Technician, p. 186, *In:* A. N. Worden, and W. Lane-Petter (eds.), UFAW Handbook, 2d ed. Publ. UFAW, London.

[3] A. E. Mundy, Animal Technicians Association, pamphlet, issued by ATA 5, Ouse Bridge Drive, Carlton, Nottingham, 1954.

[4] JATA, 8 (4):74, 1958.

on the basis of my observation, exceptional men. The associateship certificate, plus 3 years' experience are required, and successful completion of a rigorous written, oral, and practical examination. The candidate must furnish evidence of a rather complete knowledge of all phases of animal care, including laboratory procedures, animal house design and equipment, and animal house administration. An individual with a fellowship diploma is capable of supervising the operation of an animal house of any size or type.

These examinations are not easy. They are designed to test both practical and academic knowledge of animal care. In the last 8 or 9 years, about one-half of the candidates have failed the examinations. (A candidate may again attempt the examination at a later time. Many are successful.)

As an indication of the acceptance of this program, advertisements for animal caretakers in the British scientific journals are more and more commonly listing the possession of an ATA certificate as a qualification for employment. Based on observations and discussions with investigators while in England, there is no question that this program has raised the level of knowledge and competence of the caretaker tremendously. The average caretaker in the United States does not begin to compare with his British counterpart of equal length of service. While today I believe that the best animal house supervisors in the United States are the equals of their British counterparts, I do not believe that this equality will continue after the next few years when significant numbers of British technicians have received the Fellowship diplomas. As nearly as I could judge, our caretakers today are on a par with the British caretaker of about 10 years ago. The contrast in morale, ambition, and competence between them is remarkable.

In addition to certifying technicians, the ATA conducts classes to prepare candidates for the examinations. Courses are established by local branches whenever there is sufficient demand and the personnel to provide adequate teaching staffs. Last year, nine such centers were in operation. The facilities of research and commercial institutions are made available to the ATA for these courses, and many of the lecturers are members of their professional scientific staff. The courses are specifically designed to prepare students for the examinations. Typical syllabi for the examinations are presented in Appendix 1.

Present status in the United States.—As indicated above, we in the United States lag considerably behind Great Britain in caretaker education. The majority of institutions of any size generally have a more or less formal on-the-job training program for new caretakers. With a few notable exceptions, these programs rarely involve more than the mechanics of animal care as practiced in that institution. In the last few years, a number of groups and individuals have become concerned with this problem and are at present attempting to correlate their efforts and ideas to develop a unified program here. The Institute of Laboratory Animal Resources (ILAR) of the National Research Council, the Animal Care Panel (ACP), and the Metropolitan New York Branch of the Animal Care Panel all have active education committees coordinating their efforts. Berg Institute, N.Y.U.-Bellevue Medical Center, the Vivarium of UCLA and Roswell Park Memorial Institute offer courses in the principles of animal care. This summer and fall two additional courses will be offered. One at Stanford Research Institute and the other in Washington by the U.S. Department of Agriculture Graduate School. Many of these courses are correlated with the activities of the education committees mentioned above and are based on the syllabus used at Berg Institute (Appendix II).

While these endeavors represent only the beginning of a program, as yet no over-all program has been worked out by the various groups. However, I would like to, first, discuss the needs in animal caretaker education and, secondly, suggest a program to meet these needs.

The animal caretaker in most institutions in the United States today is recruited from the ranks of unskilled labor. In the larger urban areas such as New York he will have, at most, a high school education. Frequently he has not progressed beyond grade school. In many instances English is not his native tongue, and communication is sometimes difficult and uncertain. While commercial establishments have apparently realized that competent animal care requires reasonable wages, the salary scales for animal care in most academic institutions is too low to attract and keep competent personnel. This is the situation that existed in England a few years ago.

It appears to be much more difficult to form an animal caretakers association in this country than it was in England, presumably owing to the much greater geographical area and to the lack of any common focal point such as the Laboratory Animals Bureau (now the Laboratory Animals Centre) in Great Britain. Many have hoped that the Animal Care Panel might provide such a focus, but as yet it has not done so. Lacking such an association, it is necessary for other groups to take the initiative.

It is the belief of many of those concerned with caretaker education that he can best be taught the mechanical aspects of his profession on the job in his own institution. The same holds true for the essential experience in handling and observing animals. However, we feel most strongly that he must receive an adequate scientific background in order to understand the rationale behind the activities he performs and acquire the knowledge and competence to play his proper role on the research team, as useful and necessary as the research technician.

The basis of our proposed program, therefore, is to inculcate in the student the "why" instead of the "how" of animal care. From the experience with courses already given, there are few scientific subjects which cannot be presented to and absorbed by these audiences. However, the instructors must be individuals thoroughly competent in their fields and with a practical knowledge of animals and their care. It is essential that instruction be in simple terms and related frequently and directly to their daily experiences. At least in the early stages technical language should be avoided as much as possible (interestingly enough, one of the most common requests from caretakers at all levels is a vocabulary list). In our experience, instructors have difficulty in transmitting their information to the student, even though competent in their field, unless they are familiar enough with animals and their care to illustrate and relate their material to the daily experience of the student. Further, instructors thoroughly familiar with all phases of animal care but without an adequate scientific background frequently have difficulty because they are not facile enough in their subject to shift direction, emphasis, and content of their lectures in response to the needs and interests of their audiences. Teaching this type of material to completely untrained audiences is not a job to be assigned to graduate students, staff veterinarians, or supervisors merely because they are available.

One of the greatest disadvantages in attempting to establish education programs is a lack of adequate texts and manuals. A Bibliography of Publications on Animal Care has been prepared.[5] Most of these publications are too specialized, fragmentary, advanced, or insufficiently integrated for the beginning student. A number of institutions have prepared manuals and handbooks specifically designed for caretaker instruction. However, these differ widely in scope, emphasis, and quality. A list of these manuals and other publications useful in a training program will be found in Appendix III.

Visual aids.—Visual aids such as films, plastic models, and film strips can be extremely valuable aids in this type of training. While little material specifically designed for caretaker instruction is available,

[5] J. S. Cass, Kettering Laboratory, University of Cincinnati, *A Bibliography on the Care & Use of Laboratory Animals.*

much existing material is readily adaptable. The excellent plastic mounts of skeletons and parasites, corrosion preparations of circulatory systems and the like produced by biological supply houses have been found extremely useful as a means of introducing the student to the three-dimensional interior structures of the body, thus avoiding the necessity for the tedious and expensive dissections of conventional courses. The film catalogues of the American Medical Association[6] and other organizations [7–10] list a great many films which can be profitably used in training courses. In subject matter they range from simple understandable expositions of heredity and genetics to practical methods for waste disposal and vermin control. The objection has sometimes been raised that these films do not bear directly on animal care. However, any intelligent student can view a film on vermin control in a bakery or on a farm and transpose the basic information to his own situation. Unfortunately, these films must be reviewed by competent individuals to make certain they will be applicable to the audience. This is a time-consuming chore, and only a few have been reviewed to date. In Appendix IV are listed some of the films we have found particularly useful in the courses at Berg Institute. There are a few films prepared for lay audiences, such as Hemo the Magnificent, almost complete enough to be used as the lecture on blood and circulation without additional material. Three films are also available, prepared especially for the animal technician. The first of these was prepared in England entitled, "Handling Laboratory Animals." It is available from the Animal Care Panel without charge or from the Animal Welfare Institute for a small rental. This film is quite elementary and of little benefit except to the completely inexperienced animal caretaker.

Dr. Cohen, Director of the Vivarium at UCLA has prepared two films on caretaker education. While the primary purpose of these films is to arouse interest in the field of animal care as a profession, and to indicate some of the factors involved in animal care, they do provide training information useful and instructive to any caretaker audience and, indeed, to more sophisticated audiences as well.

A program for animal caretakers.—There are several practical problems in presenting an education program of this type to caretakers. These men generally cannot be spared from their jobs for long periods of time. Except in a few metropolitan areas the number of potential students may not be sufficient to justify the time and energy necessary to conduct a course, or there may not be a sufficient number of interested and competent instructors. Fortunately, the last two are not a factor in New York. During the last two years two approaches to the first problem were tried in the course at Berg Institute. In the first instance, courses were held one evening a week. They consisted of two lecture sessions with a half-hour informal discussion break between. This program produced no difficulties for caretakers in the metropolitan area, but several students came from the Albany area, a distance of about 150 miles. The fact that none of these students ever missed a session indicates the interest of students in such programs. The following year, particularly because there had been so many requests from caretakers from out of New York, a course essentially the same as the previous year was given during the summer as an intensive 1-week session. By the second day it was the feeling of the instructors that, while the students were extremely interested, faithful in attendance, and hard working, their lack of experience in concentrated training resulted in incomplete assimilation of the ma-

[6] Motion Picture Library, AMA, 535 No. Dearborn Street, Chicago 10, Ill.

[7] Ideal Pictures, 233 West 42d Street, New York 36, N.Y.

[8] Film Reference Guide for Medicine and Allied Sciences, Library of Congress.

[9] United World Films, 30 Rockefeller Plaza, New York 20, N.Y.

[10] Communicable Disease Center catalogue of motion pictures, filmstrips and slide sets, U.S. Department of Health, Education and Welfare, C. D. C., 50 7th Street, N.E., Atlanta 5, Georgia.

terial presented. This was the opinion of the majority of the students at the end of the session. Thus, while the concentrated course is much easier to handle, and simplifies the problem of student attendance, it is not suitable for the average caretaker. Unless a sufficient number of regional centers can be set up, some form of concentrated program seems inevitable. A possible solution might be a 2-week session, covering the same amount of material, with only a few hours of lecture a day and the rest of the time for informal discussions with instructors, and fellow students, and for integration and assimilation of the material presented. Many of the students in both courses felt that opportunity for discussions among themselves was extremely valuable. A system such as used at the Gordon Conferences might be ideal if funds could be obtained to defray the expenses.

The type of course discussed above is considered to be the basic introduction prerequisite to all further academic training. The over-all program of courses and content has not yet been defined but, based on discussions with the various interested groups, will probably follow the general outline below.

The individual entering the field of animal care would presumably be completely untrained. He would receive the customary on-the-job training in the mechanics of care at his own institution. After becoming reasonably familiar with animal care he would be enrolled in a course "basic principles of animal care" which would be essentially the material discussed above (Appendix II). Upon completion of the course and demonstration of experience and competence he could be considered a junior or apprentice caretaker.

A second level of achievement would be based on 3–5 years' further experience and further formal education. This would include training in the fundamentals of laboratory animal breeding and genetics, the common diseases and their clinical appearance, methods of control, and prevention. At this stage he could begin to receive instruction in simple laboratory procedures such as examination of fecal samples for the common parasites. He would receive instruction in the fundamentals of laboratory animal nutrition, preparation of special diets, and the appearance and prevention of such common deficiency states as scurvy. The various methods of anesthesia, minor surgical techniques, routes of injection and elementary autopsy technique should also be included.

During this period he might be expected to become interested in some particular phase of animal care such as breeding, experimental surgery technics, or in some particular species. With advice and direction from his superiors he could be expected to begin self study in some such field. Ideally, if facilities and time were available, he might be encouraged to carry on individual work in this field. For example, he might be placed in charge of a small breeding unit, or be given responsibility under the supervisor for a single species in the colony.

At this time he would also begin to become acquainted with the administrative aspects of the animal house. He should be taught the elements of record keeping, not only experimental and breeding records but the administrative records necessary in a large animal house.

We believe that short courses can be arranged to provide the fundamental information in most of these fields and that an outline of the objectives and requirements would enable him to obtain the rest of the information and experience in his own institution. With proof of competence and experience in these areas he could be considered a senior or journeyman caretaker.

Finally, there is the man, risen through the ranks, who can be entrusted with the day-to-day operation of a large animal colony. At the moment we can say little about the details of his training, but he should be competent to carry on all the activities of the animal house, responsible to a professional director and consulting with him only in matters of policy or in case of difficulty. He should be thoroughly familiar with the ad-

ministrative details of animal house operation, be able to contribute significantly to the education program for the junior and senior caretakers, and be able to discuss intelligently and helpfully the animal care aspects of scientific problems with investigators. In a preliminary report a group of animal house supervisors[11] has suggested that to qualify for such a position a man would require at least 10 years' experience, formal instruction considerably broader and in more depth than for the senior technician, and would be expected to have unusual competence in one or more phases of animal care. He might be an expert in the care of primates, in the breeding of unusual species, vermin control, or any of the other multitude of activities concerned with animal care.

To give meaning and direction to such a program there must be a clear definition of objectives and requirements, and recognition of accomplishment. Therefore, it has been proposed by the several education committees that the Animal Care Panel establish a board to administer a certification program. This proposal will be submitted to the Board of Directors at their annual meeting in Washington this fall. Briefly, it is proposed that the Animal Care Panel establish a certifying program for animal caretakers, that the three levels of competence discussed above be established, and qualified candidates be certified in these grades upon completion of requirements to be established by the certifying board, based on recommendations of the ILAR. The qualifications suggested, subject to approval and modification of the board, are roughly those indicated above.

It is proposed that the board be made up of two senior animal technicians or superiors, one member from the Institute of Laboratory Animal Resources, one member from the Laboratory Animal Breeders Association, and a chairman. It is further proposed that, if other organizations with an interest in caretaker training become affiliated with the Animal Care Panel, they will also have representation on the board. Finally, it is suggested that, when an organization of animal caretakers becomes established, the function of education and certification be turned over to them.*

This program is obviously modeled closely on the English system with certain modifications thought to be better adapted to the American caretaker.

Other needs.—While it is obvious that present interest and activity in animal care education are concerned with the caretaker, it must not be forgotten that all other groups concerned with laboratory animals could benefit from educational programs suited to their specific needs.

It is the unusual investigator whose knowledge of biology is broad and detailed enough to insure sufficient competence in such fields as genetics, nutrition, disease, and animal behavior to be fully aware of, let alone control, the effects of such factors in the production and use of his experimental animals, factors which can significantly influence the outcome of his experiments. For example, many experimenters insist on the use of such names as "Wistar" for their animals, apparently totally unaware of the fact that a "Wistar" rat bred in a colony removed in time and space from the original Wistar colony may differ significantly from the original animal and from all other "Wistar" animals from other colonies. The fact that such subtle influences as a change in caretakers or in the noise level in an adjoining area can significantly affect the behavior of an animal under experiment is little known and seldom believed. Many investigators are either totally unaware or drastically underestimate the effects of endemic disease on their experimental animals. A mortality of 10 or 20 per cent in control groups is sometimes dismissed as insignificant; in fact, it is unusual for the average investigator to seek expert help until his

[11] Animal Caretaker Education Committee, Metropolitan New York Branch of the Animal Care Panel, preliminary report, 1959.

* (This proposal was adopted at the annual meeting of the ACP in October, and a Certification Board is now being formed.)

mortality is over 50 per cent. When he does seek help, he does not know what information is necessary. It is slightly frustrating to receive a long distance call in our disease laboratory because of an apparent epidemic and find that not a single animal has been autopsied, all dead and ill animals have been destroyed, adequate records were not kept, and the only real information available is that some animals died before the investigator thought they should.

Animal disease is probably the most important single problem in laboratory animals today. A satisfactory text or reference book would be of great value, but unfortunately none is available. Much useful information can be found in Snell[12] and the UFAW handbook.[2] While not ideal, a text by Dumas[13] is probably the most useful on the laboratory animal diseases and their diagnosis.

It would seem that the needs of the investigator might be best served by the introduction of a one-semester course into the post-graduate curriculum for all students planning work in any field in which animals might be used. The purpose would be to acquaint them with the basic facts of biology in fields other than their specialty, and to give practical experience in the care and handling of all laboratory animals. Included would be the basic facts of genetics and breeding, disease, epidemiology, sanitation, autopsy techniques, animal handling, elementary surgery, and the like.

The research assistant and laboratory technician are frequently called upon to perform many experiments with animals even though an animal caretaker may be responsible for their procurement and maintenance. These individuals need experience and training in handling animals, anesthesia, injection. They should be familiar with the appearance of the ill animal and able to conduct simple autopsies. Since in this country, in contrast to Great Britain, most of our technicians are college graduates, a course somewhat more elementary than the one for post-graduate students might be included in the curriculum of biology and technical students.

Perhaps the greatest lack today is in properly qualified individuals to direct the large centralized animal facilities which are becoming so common in our research centers and industrial laboratories.[14, 15] It would seem that the natural candidate for such a position would be the graduate of a veterinary school. Unfortunately, few if any veterinary schools offer any adequate instruction in laboratory animals. Further, the veterinary student has had little exposure to research. We believe that in order to fully understand and efficiently serve the investigators of a research institution, the director of animal care must have not only an intimate knowledge of laboratory animals, but must also have an appreciation of research methods and philosophies, best gained by being himself an investigator.[14]

If veterinary schools are to be a source of future heads of our animal houses, it would seem desirable that they offer their students specialized training in laboratory animal medicine. For those veterinary schools closely associated with medical schools, there are obvious areas of cooperation and collaboration. It would seem appropriate for the newly formed American Board of Laboratory Animal Medicine, a specialty board of the American Veterinary Medical Association, to suggest to the veterinary schools appropriate courses and curricula.

It has been stated elsewhere[14] that the director of an animal care facility should himself be an investigator. To supplement or supplant the veterinary program men-

[12] G. D. Snell (Ed.), Biology of the Laboratory Mouse. 1941. Reprinted by Dover Publishing Company, 1956.

[13] J. Dumas, Les Animaux de Laboratoire, Editions Medicales Flammarion, 22 Rue de Vaugiarand, Paris 6e.

[14] L. R. Christensen and B. J. Cohen, Laboratory Animal Care—A New Discipline. Laboratory Animals Center, Collected Papers, The organization and Administration of an Animal Division, 7:63, 1958.

[15] B. J. Cohen, University of California, Organization and Function of a Medical School Animal Facility, *J. M. Educ.*, **35**:24–33, 1960.

tioned above, the establishment of a fellowship program, not necessarily limited to veterinarians, should be established. Under such a program, which would last for about 3 years, the post-graduate student would enter one of the large animal centers. If it were an academic institution, he might work for an advanced degree. He would be expected to carry on a research program of his own related to laboratory animals. He would participate actively in the day-to-day operation of the animal quarters, learning the practical aspects of animal care. He would spend some time as deputy director of the unit learning the administrative details of a large animal center including such matters as budget preparation, cost accounting, and personnel management. If possible he should collaborate with investigators in research projects. Recently, such a program has been organized at the Bowman Gray School of Medicine of Wake Forest College, Winston-Salem, North Carolina, under the direction of Dr. T. B. Clarkson.

SUMMARY

In summary, it appears that progress in the care of laboratory animals has not kept pace with the demands of modern research. In education in animal care, we lag far behind Great Britain. However, steps are being taken to remedy these defects. A beginning has been made in attempting to establish a nationwide education and certification program for the animal caretaker. Further steps are contemplated to supply information and training in laboratory animal care needed by such other groups as the investigator, his technician and the director of the animal house.

APPENDIX I

SYLLABUS FOR THE ASSOCIATESHIP EXAMINATION

1. Home Office Regulations regarding the Treatment of Animals
2. Physiology
   - A. Reproduction
   - B. Circulation
   - C. Excretion and respiration
3. Handling and Sexing of Common Laboratory Animals
4. Methods of Identification
5. Simple Breeding Techniques for Producing Healthy Stocks
6. Food
7. Bedding
8. Recognition of Common Diseases of Laboratory Animals
9. How To Recognize Pests of the Animal House
10. Receiving Animals from Outside Sources
11. Sending Animals by Train, Boat, Road, and Air
12. How To Run an Animal House
13. Injections
14. Elementary Knowledge of the Care and Maintenance of the Larger Laboratory Animals

SYLLABUS FOR THE FELLOWSHIP EXAMINATION

1. Understanding of the Cruelty to Animals Act of 1876
2. General Physiology and Anatomy
3. Elementary Knowledge of Micro-organisms and Internal Parasites
4. Techniques for the Isolation of Animals
5. Preparation of Animals for Manipulation
6. Pests of Animal House
7. Food Infestation
8. Nutrition
9. Breeding of Mammals
10. Elementary knowledge of the Care and Maintenance of the Larger Laboratory Animals
11. Breeding and Feeding and Maintenance of Frogs, Toads, and Fishes
12. Collecting Specimens
13. Methods of Disinfection and Sterilization
14. Animal House Design
15. Animal House Equipment
16. Administration
17. Functions of the Laboratory Animals Bureau

APPENDIX II

LIST OF LECTURES GIVEN IN 1958 BISS TRAINING COURSE

1. Life and Living Organisms
2. The Cell—the Basic Unit of All Life
3. The Skeletal and Muscular Systems
4. The Circulatory System
5. The Digestive and Excretory Systems
6. The Nervous System and Special Sense Organs
7. Endocrine Organs
8. Genetics & Reproduction

9. Nutrition and Metabolism
10. Animal Disease (4 Lectures)
11. Antibiotics Chemotherapy
12. Principles of Sanitation
13. Operation of an Institutional Animal Colony
14. Pathogen-free Animals
15. Operation of a Commercial Mouse Production Colony
16. Handling and Training of Laboratory Animals

APPENDIX III

MANUALS AND PUBLICATIONS

1. *Quarterly Journal of the Animal Technicians Association.* Vols. 1–8 (current). M.R.C. Laboratories, Woodmansterne Road, Carshalton, Surrey.
2. *The Care and Management of Laboratory Animals.* A. N. WORDEN and W. LANE-PETTER. 2d ed. UFAW. 1957. (Available from the Animal Care Panel.)
3. *The Care and Breeding of Laboratory Animals.* Edited by E. J. FARRIS. John Wiley & Sons. 1950.
4. *Les Animaux de Laboratoire:* Anatomie, Particularities Physiologiques, Hematologie, Maladies Naturelles, Experimentation. J. DUMAS. Editions Medicales Flammarion, 22 Rue de Vaugirard, Paris. 1953.
5. *Care of Laboratory Animals.* Merck Veterinary Manual, pp. 1231. Merck & Company, Inc., 1955.
6. *Biology of the Laboratory Mouse.* By the staff of the R. B. Jackson Memorial Laboratory. G. D. SNELL (ed.). 1941. Reprinted by Dover Publishing Co., 1956.
7. *The Rat in Laboratory Investigation.* 2d ed. edited by E. J. FARRIS and J. G. GRIFFITH. J. B. Lippincott Co., 1949.
8. *Animal Colony Maintenance.* Ann. New York Acad. Sc., **46**:1–126, 1945.
9. *Laboratory Animals Bureau, Collected Papers,* 1953–59, Vols. 1–8. Laboratory Animals Bureau, M.R.C. Laboratories, Woodmansterne Road, Carshalton, Surrey.
10. *Carworth Farms Quarterly Letters.* (Nos. 1–46; 1946–57). C.N.W. Cumming, Carworth Farms, New City, New York.
11. *A Practical Guide on the Care of Small Animals for Medical Research.* H. HERRLEIN, Rockland Farms, New City, New York. 1949.
12. *Laboratory Animal Care and Feeding.* Ralston Purina Co., St. Louis, Mo., 1957.
13. *Care of Laboratory Animals.* C. A. SLANETZ. Subcommittee on Diagnostic Procedures and Reagents. American Public Health Association Pamphlet. 1790 Broadway, New York, N.Y., 1954.
14. *The Dog in Medical Research.* U.S. Department of Health, Education & Welfare. Public Health Service Publications #312, 1953.
15. *Identifidation of Some Internal Parasites of Laboratory Animals.* R. T. HABERMANN F. P. WILLIAMS, JR., W. T. S. THORP, U.S. Department of Health, Education & Welfare. U.S.P.H.S. Publication #343, Washington, D.C., 1954.
16. *Comfortable Quarters for Laboratory Animals.* Prepared by the Animal Welfare Institute, 270 Park Avenue, New York, N.Y. 1953.
17. *Minimum Standards for the Commercial Production of Randombred and Inbred Laboratory Mice.* 1957. Prepared by the Institute of Laboratory Animal Resources. (Obtrainable from the Cancer Chemotherapy Nat. Service Center, National Institutes of Health, Bethesda 14, Maryland.)
18. *Control of Ectoparasites in Mice.* ROBERT J. FLYNN. Argonne National Laboratory. Proc. Animal Care Panel, Vol. **6**, 1955.
19. *Establishment and Maintenance of a Disease-Free Animal Colony.* Division of Veterinary Medicine. Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D.C.
20. Diets Manual, Biological Test Diets and Salt Mixtures. Nutritional Biochemicals Corporation. Cleveland 28, Ohio.

APPENDIX IV

MOVIES SHOWN IN THE 1958 BISS TRAINING COURSE

1. "Living Cell"—Encyclopaedia Britannica Films, Inc., 200 N. Wacker Dr., Chicago 6.
2. "Endocrine Glands"—Encyclopaedia Britannica Films, Inc. (see above).
3. "Digestion" (2 reels, nos. 1174 & 1174A)—Encyclopaedia Britannica Films, Inc. (see above).
4. "Hemo the Magnificent"—New York Telephone Company, Public Relations Department, 140 West Street, New York, 7, N.Y.
5. "Heredity" (no. 533-A)—American Museum of Natural History, Film Library.

6. "Sexual Reproduction" (no. 1147)—American Museum of Natural History, Film Library.
7. "Goodbye Mr. Roach" (no. 5–34A)—Ideal Pictures, 233–239 W. 42d Street, New York 36, N.Y.
8. "Pressure Steam Sterilization" (no. 5–590)—Ideal Pictures (see above).
9. "Animals in Research, Disease Free Colony" (no. PMF 5322)—Armed Forces Institute of Pathology, Walter Reed Army Medical Center, 6825 16th St., New York, N.Y.
10. "Rat Proofing" (no. M-37 1e)—C.D.C., U.S. Public Health Service, P.O. Box 185, Chamblee, Georgia.
11. "Fly Control Through Basic Sanitation" (no. 4-090)—C.D.C. (see above).

The University and the School of Medicine*

MELVIN A. CASBERG, M.D.†
University of Texas, Austin, Texas

Definitions.—A prerequisite to the intelligent discussion of the relationship between any two academic units of higher education is an understanding of the composition and function of these related units. Thus, our attention initially should be directed to the definition of the "university" and the "school of medicine."

The sage and the cynic, each in their own way, have had something to say about the university. Disraeli, in a speech in the House of Commons, stated that "A university should be a place of light, of liberty and of learning";[1] whereas Henry Fielding wrote that "Universities are fit for nothing but to debauch the principles of young men, to poison their minds with romantic notions of knowledge and virtue."[2]

An intriguing commentary on the university is that of L. D. Coffman, who at the time of this statement was president of the University of Minnesota. "A university studies politics, but it will not advocate Fascism or Communism. A university studies military tactics, but it will not promote war. A university studies peace, but it will not organize crusades of pacifism. It will study every question that affects human welfare, but it will not carry a banner in a crusade for anything except freedom of learning."[3]

The university is an institution of higher learning, encompassing all branches of basic knowledge. In the light of this statement it is easy to understand why universities from their inception have embraced professional schools. The university is the gateway through which people enter the professions.

The first professional education in universities was in the fields of theology, law, and medicine. Just a little over a century ago one-fourth of the graduates of American institutions of higher learning became practicing physicians. Today, because of greatly increased college enrollments as well as the multiplication and growth of scientific professions closely allied to medicine, only 2 per cent of the graduates enter our schools of medicine.

The medical school is an educational institution whose responsibility relates to the preparation of individuals concerned with, and capable of contributing to, the improvement of the health of society. The fulfillment of this purpose is evidenced in a twofold manner: first, by the education of competent physicians; and, second, by the development of an environment rich in scientific exploration and testing, better known as research.

Formal medical education, particularly through the first half of the medical school years, is but a continuation of the university curricula, with emphasis on the natural sci-

* From the Conference on Medical Education, State University of New York, College of Medicine in Syracuse, June 18–20, 1959.

† Formerly Vice-President for Medical Affairs, The University of Texas, Austin 12, Texas.
Present address: Ludhiana Christian Medical College, Ludhiana, Punjab, India.

[1] Benjamin Disraeli: Speech in the House of Commons, March 8, 1873.

[2] Henry Fielding: *The Temple Beau*, I, 1730.

[3] L. D. Coffman: *Journal of the American Association of University Women*, January, 1936.

ences. These basic studies establish a sound factual foundation on which, over the succeeding years, are built the clinical applications. Thus, in the real sense of the word, education in medicine is a continuum whose inception cannot be related to any specific period in the chronology of school years. Under these terms of reference it is pedagogical heresy to consider medical education as a separate order of professional higher education not sheltered under the academic umbrella of the university.

Relationship of the medical school to the university.—A better understanding of the administrative organization relating the university and the school of medicine to one another may be gained by an evaluation of certain problems in this relationship studied against their historical background.

The well-known report of Dr. Abraham Flexner to the Carnegie Foundation for the Advancement of Teaching, made in the year 1910, became the turning point in American medical education, particularly in its espousal of a sound relationship between the university and the medical school. Dr. Flexner urged that the school of medicine be brought under the direct responsibility and management of the university, and in the intervening years, with but few exceptions, this has become the established practice. It is now the consensus of medical educators in America that schools of medicine should operate within the framework of the university.

To conclude from the above statement that the ideal affiliation between the university and the medical school is an established fact in American education would be a fallacy. The varied and changing organizational patterns relating these two facets of education are but mute evidence that the mold is still quite fluid. Furthermore, no single pattern of organization would or should fit the great variety of affiliations existent today.

Despite almost universal agreement as to the soundness of a close university-medical school relationship and a substantial and increasing progress in this direction, there are certain distractions which have given American educators cause for concern.

One of the major sources of irritation between the university and the school of medicine is that of the high cost of medical education. The parent institution, with her burgeoning responsibilities in higher education and the restrictive factors of a chronically inadequate budget, looks with a degree of suspicion on the voracious financial appetite of this, her academic offspring.

Costs of scientific education have become staggering. For example, the total anticipated annual operational budget for the 82 approved American medical schools, exclusive of research and hospital costs, is more than 130 million dollars. In comparison, the total income of all 155 schools of medicine in 1910, at the time of the Flexner report, was less than the operating budget of one of our better endowed schools of today.

Reasons for this high cost of scientific education are not difficult to determine. They all point to the simple fact of progress. The unprecedented advance in medical scientific knowledge in the last 50 years has required improved teaching methods, with a highly competent faculty, expanding facilities, and expensive equipment. In spite of these seemingly logical explanations, the cost factor still presents a desperate issue—an issue that is prone to strain relationships between the university and the school of medicine.

Another problem relating to the unity of the university family is that of geographic separation. Although the current standard order of procedure is to place the medical school on or adjacent to the university campus, this has not always been possible. As a result, many schools of medicine are separated from their parent institutions. For example, the University of Texas has two medical schools, one located 200 miles to the north, in Dallas, and the other 200 miles to the south, in Galveston. It is quite evident that, under these circumstances, the management of a distant branch of the university poses certain unusual problems.

Parenthetically, it should be understood that mere geographic proximity does not insure correct affiliation. The proper academic bond between the institutional parent and her offspring is dependent on many other factors, some of them much less tangible than geography.

The pure academician on the university campus, despite outward denials, frequently carries a subconscious resentment against the professional school. To him the school of medicine is a training institution, a trade school with technical emphasis, rather than an institution of higher learning. In past years, and in some circles even today, there has been valid reason for this judgment. The situation has been compounded by the increasing financial demands being made on the university by the medical school. Such an attitude has and will continue to damage the philosophy of campus unity unless it is corrected.

Another factor effecting the academic affiliation being discussed is that of the growing influence of the teaching hospital on medical education. The increasing volume of clinical research made possible by federal and private grants has given the hospital a certain prestige and independence, particularly evident over the past two decades. In some areas one is hard put to determine whether the clinical faculty owe their primary allegiance to the medical school or the teaching hospital. While it is true that the teaching hospital usually is closely related to the school of medicine, this area of orientation demands a greater scrutiny lest it become a current polarizing the university at one end and the medical school at the other.

The educational versus vocational emphasis is influenced to a considerable degree by the major orientation of the medical school, as to whether this is toward the university or the hospital. No one will deny the importance of the hospital in medical education, both undergraduate and graduate; yet at the same time close affiliation of the hospital within the medical school-university system is paramount to an elimination from medical education of the stigma of a trade school.

The university graduate school, as a cohesive factor relating the various divisions of the university, plays a significant role in the unification of the total academic program. The basic science graduate work carried out in the school of medicine thus becomes the direct responsibility of the graduate school, and qualified faculty of the school of medicine become members of the university graduate faculty. Such an arrangement permits rotation of graduate students through the various divisions of the university. The significance of such an organization in integrating the various facets of a university system is quite obvious.

Administrative organizational patterns.—Having in a precursory fashion defined the structure and function of the university and the school of medicine, and having commented briefly on certain matters related to the academic affiliations of these institutions of higher learning, we are in a position better to understand the administrative organzational patterns affecting these affiliations.

There are no two schools of medicine in America with identical administrative organizations, either within the school itself or in the school's relationship to the parent university. This state of affairs is to be expected in the light of the variety of situations in which the medical schools function. In fact, uniformity, administrative or curricular, in all matters of medical education would be detrimental to the advancement of medicine.

Despite organizational variations in medical education within the university system, there are several identifiable "common denominators" which lend themselves to general application in this field. An understanding of these standard patterns clarifies the study of the more intricate variants.

The complexities of the administrative

ties of a medical school with the university are proportional to the sum of the scope of responsibilities at either pole of this relationship. That is to say, a university with a single medical school of moderate size presents no particular organizational problems. By contrast, given the same university and the same medical school, but adding to this system, for instance, another school of medicine and a dental school, and the administrative design becomes much more complex. This complexity is not by virtue of any change in the original medical school but because of the fact that the university has accepted a greater role in professional education.

Looking at the other face of this coin, with the university remaining constant in its scope of obligations, but with the school of medicine expanding into what now is popularly known as a medical center, the difficulties of administrative integration are compounded. Under these terms of reference the erstwhile moderately sized and simply organized medical school has now assumed responsibilities for an enlarged teaching hospital, with numerous specialty units; a school of nursing; increased graduate and postgraduate educational activities; schools of medical technology; and a host of other more comprehensive programs related to the health professions.

With the acceptance of the valid premise that the medical professional schools function best within the aegis of the university, and an appreciation of the varieties of academic environments in which these institutions are nurtured as well as the multiplicity of their responsibilities, it is possible to make an intelligent appraisal of the organizational form suited to accomplish these purposes.

Following the developmental or evolutionary pattern and commencing with the simplest form of affiliation, the administrative head of the school of medicine, the dean, is responsible directly to the president of the university. Reporting to the dean are the dean of nursing, the director of the hospital, the business manager and an assortment of assistant deans, as well as departmental chairmen. The chain of authority and areas of responsibility in this situation are relatively uncomplicated.

Turning next to the university with one school of medicine of the more complicated large medical center variety, one finds an administrative pattern more intricate in design. Usually the greater share of the intricacy relates to the medical school campus rather than to the university. To meet the demands of the growing complexities of the medical center, a new administrative officer has evolved within comparatively recent times. Identified by various titles such as "executive director of medical affairs" or "vice-president for medical affairs," this administrator gives leadership to the medical center, where his office is usually located, and at the same time relates these responsibilities to the university. Although in most cases the incumbent comes from the field of medicine, this is not necessarily the case, for some are recruited from the field of law, agriculture, physics, and various other disciplines.

The chain of administrative command from the office of the executive-director or vice-president for medical affairs usually passes down through four or five positions, such as: the dean of medicine; the dean of nursing; the director of hospitals; and the business manager.

The functions of this office in great part are administrative rather than educational, with the direction of budgetary policy matters as a major responsibility. Some medical educators have expressed concern over the growing emphasis on administrative and financial accomplishments in the selection of those who are to direct medical centers. With the interposition of this administrator, they envision increasing difficulties of communication between the office of the dean of medicine and that of the university president. The educators fear an arbitrary evaluation of areas of accomplishment based

on the size of the budget. The university, on the other hand, appreciating the increasing budgetary demands of medical education, finds little difficulty in defending a selection policy based primarily on administrative acumen.

A variant of the executive director or vice-president described above is one with a greater university orientation. This category of medical administrator, who is related more closely to the parent university than to the medical school, usually is associated with an institution having more than one medical school, or having other health professions schools besides medicine, such as dentistry, public health, and pharmacy. Such an individual, for all practical purposes, is the health professions "alter ego" of the university president, and is designated the vice-president for medical affairs with direct "line" responsibility for the health professions schools.

In a few instances the vice-president for medical affairs carried a "staff" rather than a "line" designation. In such a situation the administrator does not directly supervise the activities of the medical or other health professions schools within the university system, but, as a member of the president's staff, he consults with the chief administrative officers of the health education units and recommends procedures for coordinating and systematizing policies and practices. His responsibilities as a staff officer to the president include giving advice, counsel, and guidance in the area of health education.

The effectiveness of this "staff" office depends to a considerable extent on the rapport between the vice-president and the president of the university. If there is mutual confidence, the vice-president is in a position to wield a powerful influence on the health professions schools for which he is responsible. On the other hand, the office may become impotent and ineffectual and the vice-president a mere figurehead with some "bark" but no "bite."

In actual practice one finds various combinations of the standard organizational patterns presented. Several institutions, for instance, have university medical administrators who function in a dual capacity, carrying "line" as well as "staff" responsibilities. They may have only "staff" or advisory powers in relation to the school of medicine and "line" or executive control over the university teaching hospital.

The relative administrative stature of the dean of medicine usually is inversely proportional to that of the strength of the medical administration at the university level. Stated in different terms this would imply that a university-oriented vice-president for medical affairs with substantial executive powers would be matched with a dean of medicine with proportionately decreased responsibilities. Conversely, in the face of weak central control by the university, it would be expected that the dean or executive director of the medical center would assume greater authority.

From these discussions it becomes quite obvious that the dean of medicine is a person of various dimensions. The scope of his functions is controlled to a degree by the organizational environment in which he is situated. This variation in the stature of the office plays a significant role in the recruitment of a dean, for it is becoming increasingly evident that the medical administrator is being selected for a particular position rather than the position being modified to fit a particular dean.

Conclusion.—Medical educators in America are in agreement that it is to the advantage of the school of medicine to be an intimate member of the university academic family. The satisfactory accomplishment of such an affiliation is neither simple nor easy.

In the face of an assortment of structural and functional variations, no standard administrative organizational pattern exists for the affiliation of the university and the school of medicine. These variations are related to the complexities and growing scope

of medical educational responsibilities.

Each university system should study the many facets of its own particular structural and functional organization and then select the best administrative pattern leading to an efficiency of operation. The fact that a plan functions well in one institution of higher learning is no guarantee that this same result may be achieved in its application in another.

An excellent plan for administrative organization will not make amends for incompetent administrative personnel. However, competent administrative personnel may function very well in spite of poor administrative organization.

The Role of Clinical Psychology in Medical Education*

WILLIAM N. THETFORD, PH.D., and ARTHUR C. CARR, PH.D.†
College of Physicians and Surgeons, Columbia University, New York, N.Y.

Although the goals of medical training have been broadened considerably in recent years to include the social sciences, beginning students of medicine usually bring to the first years of their medical training a more traditional conception of the physician's role. For many students, indoctrinated with courses in the basic sciences as part of their premedical training, the study of psychology does not seem particularly pertinent to their training as physicians. Subsequent direct experience with patients, however, leads to a growing awareness of the complex interrelationships between physical symptoms, emotional factors, and the socio-cultural setting within which these occur. This awareness is reinforced by the emphasis on comprehensive care of patients as an essential part of medical training. As Harrower has stated, "With the increasing emphasis on psychiatry, psychotherapy, and psychosomatic medicine in the training of the physician . . . the gap between medicine, psychology and allied fields has diminished" (1).

As a result of the shifting emphasis in medical education, the clinical psychologist with an academic appointment in a medical school has both the opportunity and responsibility to present the techniques of clinical psychology in conjunction with discussions of medical problems. The field of clinical psychology is a broad one, which encompasses a number of skills and techniques. It is apparent that within a medical setting clinical psychology, with its emphasis on understanding and measuring personality and predicting behavior patterns, has a wide range of application in the areas of teaching, training, service, and research. Our primary emphasis in this presentation is on the role of the clinical psychologist in these areas, where the various measurements of personality, intelligence, and other aspects of behavior are emphasized.

The nature of psychological tests.—In the psychologist's armamentarium is included a wide range of instruments, ranging from objective tests, which directly compare an individual's performance with a normative population, to projective techniques, in which the results are much more dependent upon the psychologist's skills in interpretation. Examples of the former would be any of the standard intelligence tests, as opposed to such instruments as the Rorschach test and the Thematic Apperception test, which are perhaps the most widely used projective techniques. These instruments may also be conceived as varying in the degree to which well-structured stimuli are represented, i.e., the degree to which the test stimuli give cues for appropriate reactions. In spite of the more subjective nature of projective techniques, their demonstrated value in personality appraisal has been largely responsible for the physician's acceptance of clinical psychology. Many psychiatrists and other physicians recognize that projective techniques offer the most effective psycho-

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logical instruments yet devised for measuring personality dynamics. It is particularly with these instruments, however, that it must be made most explicit that such techniques merely elicit behavior, while clinical insights are arrived at through a complex process of interpretation. In a medical setting, the opportunity exists to relate pathognomonic test signs to those features which may be discerned from an intensive study of the patient's life history, medical problems, and modes of life adjustment.

Although the goal of psychology as a science is to evolve general laws of human behavior, at the present stage of our knowledge the most judicious interpretation of psychological tests rests upon relating this material to other data concerning the patient's dynamic functioning at various levels. Too often the clinical psychologist may be content to determine whether or not his diagnosis agrees with that of the psychiatrist, rather than attempting to achieve a fuller understanding of the patient from all the available data which have accumulated in charts, records, and through consultation with members of the medical team. Despite the practical difficulties of doing this consistently under the existing pressures of most medical settings, the scientific basis for projective personality tests will come ultimately only through efforts toward an increased understanding of all the criteria which determine the total functioning of each patient.

Clinical psychology in the undergraduate medical curriculum.—At the Columbia-Presbyterian Medical Center, clinical psychologists function at the Psychiatric Institute, the Vanderbilt Adult Psychiatric Clinic, the Neurological Institute, the Pediatric Psychiatric Clinic, the Seizure Clinic, and the Cerebral Palsy Clinic. As medical students rotate between these various services, they have an opportunity to see how psychological evaluations are made on a wide range of patients. In addition, individual conferences between students and psychologists on the psychological test findings of patients with whom the student is currently working make the learning experience a direct and real one.

The goal of instruction in clinical psychology is to enhance the scope of the medical student's understanding of personality factors and their intimate interrelationship with other aspects of the patient's functioning as a complex organism. No attempt is made to develop the student's proficiency in the use of psychological techniques, but rather to acquaint him with some of the basic tools used by the clinical psychologist in appraising personality.

To this end, formal instruction is given in the second-year course "Psychopathology" on objective psychological tests, particularly those designed to measure intelligence, and projective techniques, such as the Rorschach and Thematic Apperception tests. In the discussion of these tests, an effort is made to relate their usefulness to a variety of possible referral problems. Since psychological testing is necessarily time-consuming and expensive, the judicious utilization of existing facilities is emphasized in teaching. It is stressed that a clear formulation of the referral problem greatly simplifies the task of the psychologist as it facilitates the choice of tests to be given, simplifies an interpretation of these tests, and permits more efficient and effective report writing. An intensive seminar on the principles and methodology of psychodiagnostic evaluations is available as an elective course for medical students.

The psychologist's function in the Children's Seizure Clinic is an example of the way in which clinical psychology plays an integrated role in the medical diagnostic treatment and training program. The psychologist may be called upon to evaluate the child's emotional status if, in the opinion of the examining neuropsychiatrist, severe emotional difficulties are present. In addition to an over-all assessment of the child's emotional adjustment, the psychologist attempts to answer questions such as: Are the emotional problems related to the seizures, or did they arise independently of them?

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Did the emotional difficulties occur recently, or are they of longer duration? Is anxiety a cause of, or a contributing factor in, the precipitation of the seizures? The importance of such questions cannot be overestimated, in view of the close relationship which is sometimes found between the child's emotional status and the nature, frequency, and duration of his seizures. On the basis of information gained from the psychological evaluations, a suitable psychotherapeutic program for both the child and the mother can be instituted as an integral part of the total treatment. This interdisciplinary approach demonstrates to the medical student the complexity of both patient evaluation and therapy.

Clinical psychology in the resident training program.—Despite the varied exposure which the medical student has to methods of personality assessment, his instruction is considerably more superficial than that for residents in psychiatry, neurology, and pediatrics. Residents in these areas of specialization are provided with more intensive instruction and are required, as a part of their training, to attend formal lectures on projective techniques and other psychological tests given by a clinical psychologist. As an experiment for the current residents in psychiatry, the psychiatric director has requested that each resident administer psychological tests, interpret them, and write a report on at least one patient during his first year of residency. These tests include the Rorschach, Thematic Apperception test, Sentence Completion test, Figure Drawings, as well as the Wechsler Intelligence Scales and Bender-Gestalt test.

Obviously, this would be an impossible task in many ways, both for the resident and for the supervising psychologist, if the level of expected proficiency were to be a high one. However, the purpose of the experiment is not to encourage the resident to believe that he can take over the role of the psychologist, but rather to provide direct experience with the complexity of these instruments and the area in which they are particularly appropriate for personality diagnosis. Despite the difficulties of providing such experience and the many professional apprehensions which the clinical psychologist may have concerning the feasibility of permitting nonpsychologists to use personality tests, there are a number of compensating features. It is believed that this experience increases the depth of interprofessional communication and facilitates the acceptance of clinical psychology as a distinct but related profession which can make an important contribution to the problems of diagnosis and treatment. By delineating the role of the psychologist as a professional collaborator within a teaching and training program in psychiatry, the clinical psychologist demonstrates that his contribution is more than that of a technician. Such exposure may also contribute, in terms of more intelligent referrals, a recognition of the time and skill involved and an awareness of the contribution and limitations of personality tests.

Survey of physicians' attitudes toward psychological tests.—Recently, the several isolated facilities in Clinical Psychology at the Columbia-Presbyterian Medical Center have been reorganized as a division within the Department of Psychiatry. This integration has been accomplished to strengthen the contributions of psychology in the Medical Center. In conjunction with this reorganization, the Division of Clinical Psychology of the Presbyterian Hospital now operates jointly with the psychological services of the New York State Psychiatric Institute and the Psychological Training Program of the College of Physicians and Surgeons of Columbia University.

As an aspect of this recent organization, the Division of Clinical Psychology conducted a survey among neurological and psychiatric residents and staff members. Specifically, the purpose of the survey was to elicit evaluations of the form and organization of psychological reports from those requesting psychological services. The results of an anonymous questionnaire revealed the following information:

Typically, the *psychiatric* resident feels

that psychological evaluations should be done only upon specific referral by a staff or resident psychiatrist, rather than routinely. These residents would prefer that reports should not be confined only to matters directly related to the referral problem but should include whatever can be inferred about the patient, with evidence quoted from the test protocol in support of each such inference. He feels that a report on a patient should cite evidence tending to support different diagnoses and impressions of prognosis without trying to resolve these issues. He also considers it desirable to have testing done "blind" (i.e., without benefit of patient's clinical data) in order that it may serve as an independent confirmation of the physician's conclusions. As a rule, he feels that the most valuable aspects of the psychological report are those which deal with psychdynamics and with the estimation of intelligence. In addition, he places a good deal of stress on the consideration of possible organic factors, somewhat less stress on considerations such as the patient's developmental stage, diagnosis, and predicted behavior. In general, he believes that evaluation of prognosis and evaluation of therapeutic success are of relatively little value. On the whole, the psychiatric resident is inclined to leave to the psychologist the choice of tests to be used in a battery. However, he feels strongly that a test battery should include a Rorschach and one of the Wechsler Intelligence Scales and possibly a Bender-Gestalt, Thematic Apperception test, and Figure Drawings. The resident admits that, aside from the I.Q., most psychological test results in terms of formal scores and ratios have little meaning to him.

The *neurological* resident, on the other hand, stresses somewhat different aspects of the test report. He considers the reliable estimation of intelligence and specific inferences regarding organic impairment as being of paramount importance. He believes that information about the patient's developmental stage, psychodynamics, diagnostic impressions, and prediction of behavior, in that order, are next in line of importance. He agrees with the psychiatric resident that the least valuable parts of a psychological report are those dealing with prognosis and evaluation of the outcome of therapy. Both the neurological and psychiatric resident think that the psychologist is the person best qualified to select the tests in a battery, although the neurologist, too, virtually insists on a Wechsler Intelligence Scale and the Rorschach test. He confesses to even less understanding than the psychiatric resident of the meaning of technical test measures.

Although the findings from this survey reveal a generally positive attitude toward the use of psychological tests, it is apparent that there are a number of areas of misunderstanding as to their nature and use. In contrast to some of the varying attitudes expressed in this survey, the orientation of the typical clinical psychologist would differ on a number of issues. For example, there are many cases where a meaningful psychological interpretation is dependent upon familiarity with at least some of the clinical data. In general, psychologists believe that their instruments are being used with greatest effectiveness when they are free to make a specific diagnostic formulation and statement concerning prognosis. Whereas any statement based on personality test data is necessarily inferential to some degree and is consequently dependent upon the skill of the psychologist and the limitations of his techniques, one might question how a report which quoted evidence supporting different diagnoses and prognoses without resolving the problem would be very helpful. In part, such differences may be attributed to the training and orientation of physicians who traditionally are hesitant to make diagnoses based on any single test procedure. These differences, however, also may reflect the failure of the clinical psychologist to instruct his medical colleagues more effectively concerning the optimal usefulness of his instruments.

Research contributions.—In addition to the role which psychological tests and, par-

ticularly, projective techniques play in the teaching, training, and service aspects of a large medical center, there is increasing recognition of their potential contribution to medical research. Psychological methods of personality appraisal are viewed in many medical centers as not only essential to the best practice of medicine but also indispensable in broad areas of medical research.

In the area of psychosomatic disorders, for example, projective techniques afford a particularly effective means of illustrating the intimate relationship between physical disorders and personality factors. For example, in a current study of neurodermatitis at the Columbia-Presybterian Medical Center, projective techniques are being utilized to test the hypothesis that patients discontinuing psychotherapy differ in the amount and intensity of covert hostility and the possibility of a psychotic decompensation when faced with the mobilization of rage and hostility. The dramatic relief of the symptomatology accompanying the completion of the prescribed course of psychotherapy affords a striking criterion which illustrates the intimate interplay between emotions and physical disorders. Such studies are effective in making students aware of the operation of psychodynamic factors as revealed by projective personality tests in what might otherwise appear as purely physical disorders. Body image investigation is another area which dramatically demonstrates the potential research contribution of psychology in a medical setting. A systematic investigation of the changes occurring in the individual's perception of his body and its parts and the values placed on them when he undergoes such experiences as limb amputation, pregnancy, plastic surgery, and other medical procedures is a promising area for further exploration which may offer practical principles for the handling of such patients. Another example of the type of collaborative research where projective techniques are emphasized within a medical setting is a recent study at Cornell University Medical College of a group of 100 Chinese who had suffered the stress of dislocation from their homeland. To determine whether there was a relationship between personality and illness viewed cross-culturally, an extensive psychological test battery was administered individually to all the Chinese subjects. A quantitative assessment of over-all health, including disturbances of mood, thought, and behavior during a 20-year period, was derived from medical histories, physical examinations, and psychiatric interviews. Personality differences were found on psychological tests between the most and least healthy members of this group. Such a study as this one may be of interest in pointing up the broad areas of research in a medical setting where psychological tests are an essential part of collaborative investigations.

SUMMARY

This paper has attempted to describe some of the ways in which clinical psychology can be integrated with the training and research functions within a medical center. Although the field of clinical psychology has not reached an optimal state of scientific precision, it is believed that its present and potential contribution to various areas of medicine can be a meaningful one.

REFERENCES

1. HARROWER, M. Appraising Personality: The Use of Psychological Tests in the Practice of Medicine. New York: Norton & Co., 1952.

MEDICAL EDUCATION FORUM

Editorial

ABRAHAM FLEXNER—ARCHITECT OF MEDICAL EDUCATION

Bulletin Number Four, which was released in 1910 by the Carnegie Foundation for the Advancement of Teaching, probably had a greater impact on a field of education than any comparable report. Sadly, the author of the *Bulletin* died on September 21, 1959, just a few months before its fiftieth anniversary. Despite its impact, the Flexner survey of medical education in the United States and Canada, which the *Bulletin* reported, was only preparatory to another role in medical education that lay ahead for Dr. Flexner.

It is intriguing to find that the man who was the architect and master builder of United States medical education had no formal training in medicine. Indeed, he never had entered the door of a medical school until the day when he visited the first school in his epochal survey. When Flexner was tapped for the survey on the basis of his writings on American colleges, he was concerned about his lack of contact with medical education. President Pritchett's reply that professional schools should be studied from the standpoint of an educator not that of a practitioner settled the question.

Upon the completion of the study of education in the United States, Flexner moved next to surveys of medical education in Great Britain, France, and Germany. Germany stole his educational heart. He was impressed with the spirit that was so lacking in the United States—the University atmosphere. The combination of teaching and research in clinics and laboratories, adequate entrance requirements, and teachers who "were professors not practicing physicians" were other strengths of the German schools. France and Great Britain impressed him with the importance of opening hospital wards freely to medical students. Flexner once described himself as "quick to absorb—eager to execute." Having absorbed the virtues and defects of three major countries, he was interested to execute the changes needed in United States medical education.

Then began a period which must have brought Dr. Flexner great personal satisfaction. He joined the General Education Board of the Rockefeller Foundation, and from 1918 to 1928 he had the unique opportunity to set in motion his proposals for reorganizing medical education in the United States. The allocation of $50,000,000 from Rockefeller was multiplied many times over by Dr. Flexner's ability to persuade philanthropy and government to finance medical education. Cornell, Harvard, Hopkins, Vanderbilt, Washington University, Rochester, and Iowa were among the schools that benefited directly—all of us benefited indirectly. He was one of those rare individuals who had the magic touch to both stimulate brains and raise funds.

Throughout his survey and subsequent work, Abraham Flexner, more than any other

man, was the architect of modern medical education in the United States. Would we stand among those in the forefront in world health today if it had not been for Flexner? By his leadership in advancing medical education, Flexner contributed to the health of millions of citizens whose lives have been saved by medical research and capable doctors.

Flexner was completely unselfish in his desire to advance the cause of medical education. The Flexner Award of the Association of American Medical Colleges is a tribute to his contributions; other tributes are indicated. On the last page of his autobiograhy is a quotation that describes his attitude: "I burn that I may be of use."

JOHN Z. BOWERS, M.D.

Datagrams*

HOW MANY MORE MEDICAL SCHOOLS?

No one can predict exactly the number of physicians needed in the future or the number of graduates needed to maintain a constant ratio between the two. The Bayne-Jones report recommended at least 8,700 medical graduates by 1970. The Surgeon General's Consultant Group on Medical Education recently recommended 10,500 M.D. graduates by 1975.†

The following discussion is not based on either of the above estimates but rather upon a simple linear projection derived from past experience. These estimates of the future physician requirements correlate the expected population growth with a physician-population ratio of 132 physicians per 100,000 population which has prevailed over the last several years. Physician requirements computed on this basis and using the Census Bureau's Series II population estimates are shown in Table I.

TABLE I

ESTIMATED PHYSICIANS AND MEDICAL SCHOOL GRADUATES NEEDED TO MAINTAIN PRESENT PHYSICIAN POPULATION RATIO OF 132 PER 100,000

Year	Population Estimates Bureau of the Census Series II	Physicians Needed (M.D.)	Graduates Needed (M.D.)
1960	180,126,000	237,766	7,133
1965	195,747,000	258,386	7,751
1970	213,810,000	282,229	8,467
1975	235,246,000	310,523	9,315
1980	259,981,000	343,175	10,295

Since 1930 the annual number of medical-school graduates has averaged approximately 30 per 1,000 licensed physicians. The number of graduates projected in Table I is based on this rate.

The required number of first-year medical students and the corresponding number of graduates are estimated in Table II, assuming an attrition rate of approximately 10 per cent over the four years for each medical-school class.

TABLE II

FIRST-YEAR ENROLMENT NECESSARY TO PRODUCE REQUIRED NUMBER OF GRADUATES, 1956–76

No. First-Year Students			Graduates— 10 per cent Attrition Rate	
Year	No.		Year	No.
1956	7,824*		1960	7,133
1961	8,612		1965	7,751
1966	9,408	Graduating	1970	8,467
1971	10,350	(4 years later)	1975	9,315
1976	11,439		1980	10,295

* Actual number.

* Submitted by the Division of Operational Studies of the AAMC. Source of information will be furnished on request.

To what extent can the present medical institutions accommodate this increased enrolment, and how many new schools must be built to keep abreast of student-body expansion?

It is estimated that the present 86 medical schools (including four two-year schools) will admit about 8,250 medical students in 1960 and that by 1966, with sufficient funds for expansion and rehabilitation, the present schools could admit a maximum of 9,400 students. If this expansion occurs, no new schools will be needed until 1967. However, one new four-year school or two two-year schools must be completed and ready to admit a freshman class by 1967. Starting in 1968, at least two more four-year medical schools must be completed each year until 1976, when three will be required.

TABLE III

YEAR NEW SCHOOLS MUST BE COMPLETED: NUMBER OF FIRST-YEAR PLACES AND GRADUATES, 1966–77

Academic Year Completed and First Class Admitted	No. of New 4-Year Schools	Additional First-Year Students	No. of September Admissions	No. of June Graduates Who Entered 4 Years Earlier
1966–67*			9,400	8,031
1967–68	1	100	9,500	8,172
1968–69	2	200	9,700	8,315
1969–70	2	200	9,900	8,460
1970–71	2	200	10,100	8,550
1971–72	2	200	10,300	8,730
1972–73	2	200	10,500	8,910
1973–74	2	200	10,700	9,090
1974–75	2	200	10,900	9,270
1975–76	2	200	11,100	9,450
1976–77	3	300	11,400	9,630
Totals	20	2,000		

* Expected enrolment of present medical schools, including University of Kentucky.

If the Surgeon General's Consultant Group estimate of 10,500 medical graduates by 1975 were to be met (requiring 11,667 freshman admissions in 1971), 21 new four-year schools would be needed by 1971 and an additional 12 more by 1976. Thus, if the Surgeon General's recommendations were followed, a total of 33 new four-year schools would have to be in operation by 1976. This is 13 more schools than the estimate shown in Table III.

† NOTE.—The estimate of 11,000 physician graduates published in the Surgeon General's Consultant Group report has been adjusted to exclude 500 osteopathic graduates. In a previous release of these data, the figure was adjusted to exclude 600 osteopathic graduates. In 1959, the schools of osteopathy graduated 470 students; at the present rate of growth, the number could well reach 600 by 1975. The difference between the estimate of 10,500 medical graduates and that of 9,300 developed in the Datagram is accounted for in the larger figure by the anticipation of variables not taken into account in making a simple linear projection.

Addresses

THE RELATION OF MEDICAL SCHOOLS TO UNIVERSITIES*

ROBERT A. MOORE†

It is a real privilege to participate in a program to do honor to John Youmans. I am only sorry I was unable to be here yesterday for the symposium and the dinner. All of you here in Nashville know of the tremendous contribution John has made to medical education at Vanderbilt. Some of you may not know of the equally great contribution he has made at the national level. Let me tell you of just one incident which is illustrative of his devotion and selflessness. In May, 1955, the Congress was considering the bill to provide federal grants for construction by medical schools. It seemed possible favorable action might be taken, but a little extra push would be needed. A group of us met in Washington to map strategy. It became apparent someone, fully knowledgeable in medical education, would have to spend the greater part of June in Washington. Without hesitation, John agreed to do so. The bill which passed covered only research construction, but no doubt John's efforts in 1955 will have a material continuing influence for educational construction. Thus, we might say that every medical college and university which in the last two years has received a grant for research construction owes a little to John Youmans.

The committee asked me to speak on the relation of the medical school and the university. It is really presumptuous for anyone to speak on this subject in Nashville and at Vanderbilt University. After all, it was here over 30 years ago that the major policy decision was made to locate the reorganized and relocated school of medicine and hospital on the university campus, and I know John Youmans has worked long and diligently to make this physical proximity mean close intellectual integration.

Perhaps the committee knew of my varied experience in medical schools with different university relations. When I entered medical school in the fall of 1924, the medical buildings at the Ohio State University were those of the old Starling-Loving Medical College, 2 miles distant from the main university. Midway during my freshman year we moved to new Hamilton Hall on one corner of the large campus. In 1928, I joined the faculty of Western Reserve University, where the medical school then and the hospital soon were located on the relatively small campus. In 1933 I moved to New York where the Cornell Medical College is hundreds of miles distant from the University in Ithaca. From 1939 to 1954 I was at Washington University in St. Louis, where the medical-dental campus is 2 miles across Forest Park from the University. Then, for a short interlude, there was Pittsburgh, where the Cathedral of Learning is a short 4 blocks from the medical center. And now, in Brooklyn, there are central administrative offices in Albany, but at no point next door or a hundred miles away is there a large central university campus of State University

* Read at the Symposium on Medical Education in honor of John Barlow Youmans, Nashville, December 5, 1958.

† President of the Medical Center, State Univ. of New York, Downstate Medical Center.

of New York. Thus, I have experienced every variation from the medical school on a small tightly knit university campus through the medical school 4 blocks, 2 miles, and 200 miles distant to the medical school with no central university.

First let me say as strongly as I can that the mere physical existence of a medical school on a university campus means little or nothing on close relations of the two. It takes more than physical contiguity to make a group of colleges into a real university. The physical contiguity may be nothing more than a group of buildings brought together so they can be served by the same power plant. On the other hand, when there is physical contiguity, a close intellectual and administrative relation is more easily realized.

Second, I wish to point out just as strongly that this matter of a close relation of a medical school and its parent university is bilateral and involves such items as desire, need and acceptance by both administration and faculty on both sides.

Third, although most of the recent public discussions of the relation of medical schools and universities has emphasized the need of a close relation by the medical school to its university, I believe the university equally needs its medical school and the medical faculty. Let us not forget that the four faculties of most original medieval universities were philosophy, law, theology, *and* medicine.

If in this presentation I mention Washington University more often than others, it is only because I was there longer than at the others and in an administrative capacity.

Now, let us turn to some of the objective and subjective factors which constitute a close and desirable relation between the school of medicine and the university. The first of these factors which I wish to discuss is the interrelation of the chief administrative officer of the university and the medical faculty. There are many facets of this relation. First and foremost is presence of the chief administrative officer at the meetings of the medical faculty, both general faculty and executive faculty, and his assumption of the chairmanship. At the Washington University School of Medicine it was established in 1910 that the Chancellor of the University would attend and preside at every executive faculty meeting at the Medical School. In the 15 years I was there three chancellors continued this tradition and missed very few meetings. As the presiding officer, they took no part in the discussion, unless asked to express an opinion. The dean, as vice chairman, arranged for the meeting and actually ran the meeting until some motion was made, when the chancellor took over.

This participation in executive faculty meetings meant a great deal to both sides. To the dean and the department heads the mere presence of the chancellor gave them assurance of his interest in the problems of the school of medicine and a certain knowledge that he was aware of them. To the chancellor here was a means of communication in both directions. As the presiding officer the chancellor could not only hear but sense the feelings of the departmental chairmen and detect the tone and direction of the discussion. When his opinion was asked, as it frequently was, his presence gave him a chance to pass on to the departmental chairmen his own thoughts or official university policy on the problems under consideration. His attendance also placed him in an excellent position to relay to the Board of Trustees not only the recommendation, but also the thinking of the executive faculty.

In contrast, when I went to Pittsburgh, I found that the chancellor did not attend meetings of the faculty of any college. As a result, at least in part, there were established many devious routes of communication to Trustees and other influential men and women in town. I shall not discuss here whether this is good or bad, but only point out that it resulted in considerable confusion in the minds of Trustees of just what this or that college really

wanted. When I discussed this matter with the chancellor, he suggested that I, as vice chancellor, might attend in his name and preside. This was not an adequate substitute for presumed reasons, which I need not detail here.

My point is that the attendance of the chief administrative officer of the university at faculty meetings of the school of medicine is a powerful force in bringing the university and school close together. It is possible and equally effective whether the school is one block or 100 miles from his office.

The second factor I wish to discuss is the relation of the dean of the school of medicine with the other administrative officers of the university: that is, the president or chancellor, the chief academic officer, the business officer, and the other deans. The dean of the school of medicine has a heavy responsibility in this area of interpreting this colossus called the medical school to his associates. He starts out, to use a colloquial expression "behind the eight ball." Many of his associates are convinced that the only reason they do not have this or that is because the medical school has most of the money of the university. Let me tell you two stories to illustrate the point in reverse.

In the late 40's, a businessman became vice-chancellor at Washington University. Early in his experience he detected the relatively large budget of medicine, and I was attempting to justify it. Finally, I said "But, skipper, you must understand medical education is the most expensive education there is." He promptly retorted, "Oh no, the most expensive is intercollegiate athletics."

The other story is concerned with my abortive attempt to establish a program of security for the families of young full-time faculty at Washington University. In a meeting with the chancellor, the dean of faculties, and the business officer, I outlined the plan for substantial group life insurance for those in the 30's, decreasing as the annuity program became more significant in the 40's and 50's. I pointed out that the medical school had the money to initiate the program. The business officer stated that the university was in no position to do the same for the other colleges. The chancellor turned to the dean of faculties and asked, "Should we permit Bob to do this?" He replied at once, "Certainly, if he gets it now, we will have it in a few years."

During the last year I was at Washington University a council of deans was organized to meet once a month. Before this our contacts were largely social. At Pittsburgh, this concept of a monthly meeting of the university administrative officers had been accepted for many years. It brought me at once into close contact with them, and within a year my relations with them, at least from my standpoint, were excellent. In 1956 at Pittsburgh a smaller group, consisting of the chancellor, the vice chancellors, the assistant chancellors, and a few others, was organized and met weekly for lunch and during certain periods several times a week at 5:00 in the afternoon. In addition, this group met three times a year outside the city for 4 days. Within months these nine men were a closely knit group. Each knew, understood, and respected the others' problems. There was a give-and-take which is rarely seen in a university group.

My second point, then, is that there must be a close personal relation and mutual respect established between the dean of medicine and all other university officers if the school of medicine is to be an integral part of the university. This is not possible if they are separated by long distances and is only fully realizable if the school of medicine is on the university campus.

The third factor leading to a close relation between medicine and its university I wish to

discuss is the association between faculty members, particularly senior faculty at various levels and in various activities. Let us take, first, the matter of the senior university faculty, usually called a senate, composed of all those holding tenure posts. It is difficult at any time to interest the medical faculty, especially the faculty in clinical departments, in this sort of activity, but when there are any more than short distances between the school of medicine and the university, it becomes impossible. At State University of New York, with campuses in 39 different cities in the State, the situation is hopeless. The substitute which has some advantages, is to have each campus designate one or more men to attend a meeting twice a year to discuss all university academic matters. Each then reports back to his own faculty.

At Washington University the situation was, I believe, almost unique. About half the tenure people at the Medical School attended senate meetings and the executive committee of the senate, composed of five men elected by proportional representation with everyone voting for all candidates, always had one, and at times two, members of the medical faculty. The executive committee elected its own chairman and about half the time elected one from medicine. I take all of this to mean that, in spite of the 2 miles across Forest Park from Kingshighway to Lindell and Skinker, there were more than the usual respect and regard between the faculties, and the medical faculty was accepted as a part of the university. This was because the medical faculty acted like academic people, attended senate meetings, had ideas about academic affairs, and expressed these ideas. I can speak feelingly about this, because I was chairman of the executive committee of the senate in 1945 when the newly appointed chancellor undertook to abolish "professional" football. During that same year I persuaded the faculty and Trustees to change the by-laws of the Senate to exclude from eligibility for election to the executive committee all deans, full, associate, or assistant, under the theory that one cannot represent both faculty and administration at the same time. Four months later I was elected dean of the medical school, and I no longer had to deal with football, professional or amateur, as a faculty member.

Another point at which the senior faculty of the entire university come together is in the graduate school. There is probably no other area in which the medical faculty can demonstrate their right to be regarded by their colleagues as scholars than in the direction and quality of the graduate study they carry out. The capacity to demonstrate their scholarship may not always be given to them. Earlier in this paper I stated that a close relation of medicine and the university is a bilateral responsibility; neither side can accomplish it alone.

Some months ago I visited a university in which the medical school and its teaching hospital are on the university campus. The medical faculty was a fine group of academically-minded men, but I was told that the graduate council of the university had done about everything it could to block full acceptance of graduate study in the medical school for the Ph.D. degree. At Pittsburgh in 1954 the only graduate work in the medical school was in biochemistry, and the five health schools had no representation on the graduate council. It is a mystery to me why, in the minds of many, chemistry, physics, and biology are academic subjects, but the moment these same subjects are transplanted and slightly modified into biochemistry, biophysics, and anatomy and physiology, they are no longer academic, but applied professional or even technical subjects. The subject matter of a discipline has nothing to do with academic or scholarly implications; rather, it is how the subject matter is dealt with and presented. Human anatomy can be just as scholarly as Greek or history, if the right man represents it.

Let me tell you another story to illustrate my point. In 1947 Dr. Carl V. Moore and I were at Los Alamos. Dr. Carl was invited to give one of the regular weekly scientific lectures. He chose to speak on iron metabolism. The audience, as you may well guess, was composed largely of nuclear physicists and chemists. As I stood in the entrance hallway before the lecture, I could hear overtones of "waste of time," "what can a doc tell us." As I stood in the same spot after the lecture, one man expressed the thoughts of all well when he said, "I had no idea a physician could be so scientific and so profound."

My third point, then, is that a close relation between a university and its school of medicine can not exist, regardless of physical contiguity, unless the medical faculty demonstrate their knowledge and interest in academic and scholarly matters and come to enjoy the respect of their colleagues in other colleges. In the reverse, the colleagues must come to respect the problems of medicine and accept medicine as a part of the university. However, all this is more easily accomplished when the university and school of medicine are physically close together.

There are many other aspects of the relation of a university and the school of medicine which could be discussed, but I shall mention only in one sentence the contacts which come from a faculty club, where those from all colleges come for lunch or for other social activities. This is one of my most lasting memories of Western Reserve University.

Let me summarize briefly: From my own experience, I favor, without reservation, the location of a medical school on the university campus. However, I am convinced that close physical contiguity only makes possible the close intellectual relation which we desire; it does not create it. It is the responsibility of administrative officers and faculty on both sides to weave everyone together as a total university in which there is mutual respect.

A REPRESENTATIVE OF THE FEDERAL GOVERNMENT LOOKS AT MEDICAL SCHOOL PUBLIC RELATIONS*

JOHN E. FLETCHER†

Implicit in the title of my talk is a separation between my work and yours, suggesting that these remarks on medical school public relations will be objective and detached. It is my observation, however, that neither my own work nor the program of my institution is significantly different from yours in terms of public relations. This is a comparison that may not have occurred to you. However, I believe I can enumerate some important similarities between a medical school and a Federal agency engaged in the conduct and support of medical research.

You are concerned with the establishment and maintenance of a sound public image of your medical institutions; so are we. You must understand and follow the special standards and traditions for public communication that govern in the health field; so must we. You report and interpret policies that protect the rights of patients in your teaching hospitals; so do we. You are concerned with medical education and medical research; so are we. You are involved in seeking to strengthen relations between the local medical society and your institution and its staff; so are we. You are concerned in fund-raising, in lectures and other special events, in public inquiries of all kinds, in the use of mass media for public and some professional communications in the health field; so are we.

Thus, I can speak of medical school public relations and its impact and opportunities in the light of parallel and similar interests. And it will be understood that my remarks, suggesting problems and deficiencies, relate to a total field of which the medical schools are but a part.

In ever-increasing numbers, people all over the United States are carving out communication careers in the health field. They are found in the university world, voluntary health agencies, hospitals, medical societies, industry, government, State and local health departments, foundations, and professional medical and scientific societies. They go under such identities as public relations, medical writing, health education, public information, and so on. While they have many characteristics in common, a single factor describes and unifies them all: the focus of their work is to keep the public informed in the field of health. It is my conviction that this group is more homogeneous than is apparent. And I might add tangentially that I should welcome the birth of some truly representative national society dedicated to the fostering of health communications as a profession.

If I seem here to avoid the term *public relations*, it is a result of my conviction that it describes inadequately our total function. Most of us have responsibility for the design and execution of a communications program in support of the mission of our institutions. Public relations planning and counsel are, it seems to me, only part of that broader role.

* Presented before the Medical Section, American College Public Relations Association, at French Lick, Indiana, on July 15, 1959.

† Chief, Office of Research Information, National Institutes of Health, U.S. Public Health Service.

When I use the term *public relations* in this discussion—as we all do for convenience—you will know that I have in mind an "Assistant to the Dean for Institutional Communications" in a staff sense combined with a "Director of Public Information" in an operating sense.

Any public relations program derives its essential character from the nature of the activity it serves. But I shall not undertake to characterize the medical schools—their similarities and differences, their strengths and weaknesses. Instead, I shall simply enumerate some of their current and future problems as I see them. These are problems of the schools, but they are also national, because the schools are an indispensable national resource. Thus, the solution of these major problems is dependent upon national action—and this can be rapid and affirmative only if the people and their representatives and leaders are informed and stimulated to act. This is essentially a matter of effective communication.

How will the nation, then, and the schools, meet the problem of the increasing disparity between income (from tuition, endowment, and other sources) and the full cost of modern medical education?

How will presently inadequate physical facilities be renovated and expanded to meet the total need of the schools in terms of their current enrollment?

What will be done, either through enlarging the enrollment of today's schools or creating new ones, to produce the increased number of physicians and scientists required for the population growth, research expansion, and other demands that are already evident for the years ahead?

How can faculty positions, both teaching and research, be made more stable and more competitively rewarding, and thus improve career opportunities for the staff?

What can be done to raise the number and quality of students seeking admission to medical schools?

What can be done to increase the limited support the medical schools now receive annually from industry, the health professions, and other nonfederal sources?

How can the present imbalance between the research and teaching funds available from the Federal Government be redressed?

How can the schools' growth in freedom and opportunity to pursue their independent program objectives be assured when they are increasingly financed by "outside" sources?

These are some of the big problems that face the medical schools as a whole. Others are the increasing evidence of stress between certain schools and their parent universities; the tremendous growth of medical schools in postgraduate education; the relations between the medical, teaching, and other hospitals in the community; the issues posed by geographic restrictions on admission and by the heavy influx of foreign interns and residents; and the running battles between schools and medical societies over the participation of faculty in medical care.

How will such issues, immediately or potentially affecting the American people in a very direct and personal sense, be met and resolved?

Certainly it will not be simply through local action, however bold and affirmative. I am an advocate of decentralization and local autonomy, and a strong believer in the aggregate impact of local action on the national scene. It is obvious, however, that many of the basic issues cannot be met except through concerted effort on the part of the medical schools and their proponents—effort that will help lead to a modified national policy embracing a definitive plan.

The individual members of the medical school family are quite adequate in their own communications, serving effectively as spokesmen for their professional field or discipline. Teachers can be fine ambassadors for higher education; scientists reflect credit on research and its contributions to society. Moreover, I know from my own observation that the medical school's local image, by and large, is a good one.

But there are two messages that are not being heard and recorded. The first is the true national significance of medical education and the service the schools render to all people everywhere, by training not just young physicians but a host of others in related fields and at postgraduate levels. The second is the medical schools' total needs, looking ahead to years of challenge and opportunity. In effect, this means that the schools are better communicators in an individual sense than they are as a group.

I do not mean, of course, to minimize the work of your national representative, the Association of American Medical Colleges, which is relatively young and full of promise. But it will take a sustained, diversified, and creative communication process to have the kind of impact that is needed—a process in which you not only communicate for yourselves, but also encourage others to communicate for you.

There is a tendency for the medical schools in a collective sense to be defensive and negative rather than affirmative and positive, to play down stressful facts yet to want remedies—to suffer, as it were, from a withdrawal syndrome. It is this tendency more than any other which threatens to delay the kind of forward movement that is clearly indicated when one equates the role and contributions of the medical schools with the public interest.

There are understood restraints and recognized anxieties that limit the schools' capacity to influence actively the course of events affecting their operations. But these are dynamic times for health and medical affairs in the United States and abroad, and the pressures of the times are unlikely to permit some decision to be long postponed. It would seem imperative for the medical schools, both individually and collectively, to find effective ways to take part in and influence the decision-making processes. The need can be epitomized by a single challenge: What can be done to gain for medical education the recognition and support now accorded medical research?

This brings me back to medical school public relations. For the key to solving these problems, I repeat, is improved communications. And improved communications are in no small measure the product of the trained and dedicated communicator who is given the opportunity to use his talents to the fullest because he merits the confidence and support of the program he serves.

Having found many parallels in our work, I should like to draw on our experience at the National Institutes of Health in illustrating several points. I believe you will be able to translate these thoughts to your own setting. They will be in no particular order, and no one of them will be developed more than is necessary to be provocative—or, more likely, provoking.

1. We find a health institution extremely difficult to represent. The traditions are so deeply rooted and the sensitivities so close to the surface that practically none of the familiar communications techniques and patterns can be automatically applied. It takes special talent and understanding to help our Institutes achieve the kind of communications they want (though they might not admit it) and need (though they may not know it.)

2. Most scientists and educators in the health field seem to have developed or inherited a built-in distrust of public information and its people and processes. Gaining their confi-

dence and respect is a time-consuming and often disheartening task. Such confidence and respect must be earned, not assumed as a prerogative of one's job.

3. It is our experience that a public information person too often defines his province in too narrow terms, limiting himself to press and publicity and occasional use of other media, and rejecting as inappropriate to his function a host of other ways to be of service. There is ample opportunity for one to earn a permanent niche in the medical environment if he applies his talent and experience to the total communications needs—internal and external, professional and public.

4. In somewhat the same vein, we have found that, when a program and program people are generally opposed to public information and its representatives, it is better not to force the issue, but rather to win them over by demonstration.

5. It seems to us essential for the head of public information and public relations in any organization to serve as a staff arm of the chief administrator, participating in staff discussions and policy formulation. At the same time, we feel he must be the operating head of the public information staff. This may create an organizational problem, but we know no other way. It is particularly important for the communications head to be placed for administrative purposes under the program head and none other.

6. I know that some of you represent a medical school per se and some a family of health and health-related schools. Some of you are quite autonomous in a functional sense, and some are linked directly or indirectly with a university communications complex. Such questions of organization are often an issue but, it seems to me, are less important in terms of the job to be done than the fact of having a public information and public relations staff with direct responsibility for the medical and health field. When this circumstance exists, it should be fairly simple to find a workable relationship with those who represent the same function at a higher or lower echelon.

7. The individual with the special combination of talents and experience required in medical public relations is almost impossible to find when one is recruiting. Usually we seek someone who combines four qualities—a sound basic education, a capacity to write, an interest in the health field, and the personality and ability to undertake successfully all kinds of communications projects, and then move forward from there. One of the acute needs in our field is more and better trained people, and we feel that everyone who possibly can should find a way to help in this training process.

Parenthetically, I feel that a special quality to be looked for in medical public relations people is a zeal approaching an obsession for truth and accuracy. These, it might be said, are matters of judgment. But in a field that is so tinged with shades of grey rather than blacks and whites, it seems that the communicator has a great responsibility to probe until he comes as close as possible to the truth. He should state consensus as consensus, not unanimity; report minority as well as majority views; and present the factors that may have led to a given course of action. Moreover, the communicator has a special responsibility to do more than merely mirror or report; health and the health sciences are difficult at best for the average person to understand. It is the demonstration of this judgmental and interpretive quality that is required more than anything else if medical communicators, like lawyers and others for whom the factor of discretion is paramount, are ever to win stature as a profession.

8. We find the public information and public relations function to be the last item to be included in budget formulation and the first to be cut in budget reduction. Perhaps this is

an occupational hazard which you do not share. In any case, a prime objective should be to have informational activities recognized as part of program rather than superimposed on program, and this means budget and related planning.

I should like now to make two final points, both in the form of wishes.

First, I wish every medical school or medical center complex had a public relations office or some individual trained in public relations. This is an unselfish wish for the schools and a selfish wish for me and my colleagues. There are many benefits the National Institutes of Health would derive from strengthened public relations activity in all medical schools. More than $125 million in tax funds which the Congress appropriates for our nine budgeted programs was granted last year to the 84 medical schools. This represented about 25 per cent of the money used by the schools for all purposes. Reporting to the public on our administration of these funds is our responsibility. Reporting to the public on results obtained through use of these funds is yours. For the schools and for us, these reporting responsibilities might be both simplified and more effectively discharged if each medical school had a trained public relations officer to whom we could send information and with whom we could cooperate as appropriate. Going one step further, if there were a comprehensive and effective public relations linkage among all the schools, and if this were available for cooperation with outside groups, a great deal more could be accomplished than would serve both our mutual and the public interest.

My second wish is that some positive mechanism could be brought into being through which the medical schools and related institutions could exert a great influence on the sweep of events which presently or potentially affect the schools in a direct sense and, through them, the people as a whole. For there are great political, social, and economic challenges that lie ahead. Among them are many that are sure to lead to fundamental changes in what we now accept as the role of health and medical institutions and agencies.

The medical schools, both alone and in their total professional and organizational context, are at the center of the Nation's health resources. It is extremely important for knowledge of their point of view and objectives to radiate outward with the kind of force, dimension, and clarity that will ensure a marked influence on emerging national policy in the health field.

Report

THE ARGENTINE SOCIETY OF MEDICAL EDUCATION

The Argentine Society of Medical Education has been formed for the study of problems in medical education, with special and immediate emphasis on:

1. The establishment of postgraduate residency systems in federal, municipal, and private hospitals.
2. Modernization of the hospital system.
3. Creation of specialty accreditation and recognition in the various medical fields, i.e., Argentine Boards of Internal Medicine, Boards of Surgery, etc.
4. Collaboration with medical, scientific, and educational organizations with similar objectives.

The Executive Committee consists of the following persons: Dr. Ezequiel Holmberg, President; Dr. Jorge Manrique, Secretary; and Dr. Armando Mendizabal,* Dr. Jorge Firmat, and Dr. Carlos Giantonio, members.

All correspondence should be directed to the Secretary at the Society address.

* Dr. Mendizabal replaces Dr. A. Alvarez, who resigned from the Executive Committee of the Society.

ABSTRACTS FROM THE WORLD OF MEDICAL EDUCATION

ANGELA SANCHEZ-BARBUDO, PH.D.
Abstract Editor

A Critique of Teaching Psychosomatic Medicine. MILTON ROSENBAUM, M.D. Psychosomatic Medicine, Vol. XXI, No. 4, pp. 332–39. July–August, 1959.

In this paper, Dr. Rosenbaum (from the Dept. of Psychiatry at Albert Einstein College of Medicine) discusses the teaching of psychosomatic medicine under each of these four broad headings: (1) subject matter, (2) the students, (3) the teachers, and (4) the teaching techniques. One of the reasons why the teaching of psychosomatic medicine has become such a complex affair is, according to the author, the absence of precision in the connotation of the term itself. In his definition, it is regarded as an approach to clinical medicine rather than as a specialty or particular discipline to be applied in the treatment of a particular group of diseases (cf. Rosenbaum and Reiser, Principles of Management of Psychosomatic Disorders, *M. Clin. North America*, May, 1958). It is based on the following main principles: (1) shift of the focus of attention from the disease process to the sick person; (2) recognition of the mutual interaction of physiological and psychological processes, and of illness as life experience, capable of producing behavioral sequelae inextricably interwoven into the clinical picture; (3) incorporation into the practice of medicine of the best and most modern psychodynamic understanding of human personality function; (4) recognition of the doctor-patient relationship as a pertinent factor in understanding, and thereby influencing, the patient's clinical course. It is stressed that the psychosomatic approach in no way is meant to substitute for traditional medical procedure. Teaching programs in psychosomatic medicine are directed to undergraduate medical students (mostly in their clinical years); to graduates during their residency training; to teachers in the various specialties; and to practitiontioners. Some of the obstacles *within* the student, which prevent the easy assimilation of the principles of psychosomatic medicine, are discussed at length. Foremost among these is the fact that students tend to equate it with psychiatry, thus activating some of the well known resistances toward psychiatric teaching (this error is not surprising in view of the fact that the moving spirits in programs of psychosomatic medicine are usually psychiatrists, and teaching is often done within that department). Difficulties may also be encountered in what concerns the liaison service between Medicine and Psychiatry, resulting from the fact that the main responsibility lies in the Department of Psychiatry. Research programs, it is suggested, should be firmly established within the Department of Medicine. There is no reason, furthermore, why liaison services, usually between the departments of Psychiatry and Medicine, should not also be established between the departments of Psychiatry and Surgery, since surgical patients are as useful as medical patients for the teaching of psychosomatic concepts. As to the attributes a good and efficient teacher of psychosomatic medicine must have, it is required that he be highly trained in such a

way that he possess a firm grasp on data relating both to mind and body, since the findings of the physical sciences no less than the concepts of psychoanalysis are needed today to understand the human person (the introduction of psychoanalytic concepts into medicine has been, according to the author, perhaps the most significant single factor in the development of psychosomatic medicine). However, teachers of psychosomatic medicine are usually well trained in either medicine or psychiatry, and even in the rare case when he is highly trained in both, the teacher's primary interest belongs nearly always to psychotherapy or psychoanalysis. A *sine qua non* for the teacher of psychosomatic medicine, however, whether primarily a psychiatrist or an internist, is that he be personally engaged in treating patients and assume full responsibility for long-term patient care (rather than be limited in his clinical work to ward rounds or occasional consultations). All this, it is noted, points to the "unwelcome fact that the well-qualified teacher of psychosomatic medicine is painfully rare." Among the teaching techniques currently in vogue, the "Psychosomatic Conference," "Ward Rounds," "Tutorial Sessions" are mentioned, as well as "Individual Supervision," and "Continuous Case Seminars." Most teaching programs are not confined to any single one of these. Although there is a lack of careful evaluation studies on the effectiveness of these different methods, those working in this field seem to be agreed that the most effective teaching method in the psychosomatic field is one that allows the student to maintain prolonged contact both with patients and with teachers. An optimum benefit is gained, in the author's opinion, for both student and teacher, if the student has full responsibility for the continuous care and management of the patient.

Medical Education in Scandinavia. A. G. HEPPLESTON, M.D. The Lancet, Vol. II, pp. 199–202, August, 1959.

The author, a member of the Department of Pathology at the University of Wales, records in this article his impressions from visits which he made in 1958 to six Scandinavian schools. (Denmark has two medical schools; Norway has two; and Sweden four, besides the Karolinska Medico-Surgical Institute in Stockholm, where medicine has also been taught for many years.) In Denmark the number of students admitted to medical school is not restricted (about 300 enter each year), but selection is automatic at a later stage (30–50 per cent, failing to pass the preclinical examinations after several attempts, drop out of medical school). In Norway and Sweden, however, only 25–50 per cent of the applicants are admitted, since these countries try to regulate the supply of doctors according to the needs of the population. Selection is based exclusively on the grades obtained at the *examen artium* (the final *gymnasium*—high school—examination). Some 400 medical students are yearly admitted in Sweden, about 140 in Norway. A radical curriculum reform in 1955 reflects the recognition that it is not the objective of undergraduate instruction to produce persons fully qualified to practice all branches of medicine; that in view of the rapid growth and enormous accumulation of medical knowledge, emphasis must be on scientific schooling to provide a sound theoretical foundation for further practical training in the different branches of medicine. The length of the medical course, formerly lasting 8–9 years, has been reduced to 7½ (further reduction is contemplated in Denmark and Sweden). The premedical and preclinical sections of the course are not as abruptly demarcated as in Britain and the U.S. During the first phase of training, special attention is given to the medical aspects of chemistry, genetics, psychology, and statistics; general anatomy is started immediately. The inclusion of philosophy (Denmark and Norway) and Latin as subsidiary subjects in the 1st year reflects the concern to maintain a broad liberal university discipline. In general, little stress is now put on the details of descriptive macroscopic anatomy (macroscopic and microscopic anatomy are correlated by running

parallel courses of instruction; neuroanatomy and neurophysiology also are often combined); radiology and surface anatomy receive much attention. More emphasis is now being placed on medical physiology and biochemistry. An important feature of the new Swedish curriculum is the propaedeutic-clinical year (3d year of study) which is devoted to introductory surveys of general pathology, bacteriology, medicine, surgery and pharmacology from the more theoretical viewpoint; training in clinical methods and laboratory procedures during this period is aimed at making easier the transition to clinical work. The study of pathology continues throughout the clinical years, with emphasis on diagnostic laboratory procedures. Noteworthy in the medical curriculum throughout Scandinavia is the emphasis given to pediatrics in all its aspects; to psychosomatic medicine, psychiatry, and to social medicine. Integration of instruction in the different subjects forms the cornerstone of the new Swedish system (introducing certain techniques, familiar in the U.S.A., into the framework of the old continental system). The main innovation consists in cooperative teaching between several departments on especially important or difficult subjects (such as renal and hepatic disorders, for instance). Clinical clerkship with bedside teaching, and clinicopathological conferences (*C.R.P.*), are essential parts of the whole period of clinical training. There are excellent facilities for postgraduate training and research in all Scandinavian medical schools. Specialist training lasts 5–10 years (graduates usually move from small peripheral hospitals to the larger, then to teaching hospitals; senior clinical positions are rarely filled by candidates under the age of 40–45). Although, as the author points out, it is still too early for a full appraisal of the Scandinavian experiments, a few tentative opinions can already be voiced. It seems clear to him that the Scandinavian experience proves that the medical curriculum cannot be reformed merely by some independent adjustments of departmental instruction to present needs, but that a general agreement on the relative contributions from each department demands broad viewpoints, clear objectives, and the sacrifice of detail for principle. It is also pointed out that the Scandinavian approach to the preclinical period provides a more valuable background for medical training than does the British system. On the negative side, the author found the Swedish curriculum was over-organized and still too comprehensive; all clinical courses seemed to need more selection of their content, so that more time could be left for self-instruction, and in Scandinavia, as in Britain and elsewhere, more opportunity is needed for students to acquire the habit of inquiry, to learn the meaning of logic and the value of critical assessment (the Danish clinical curriculum was less crowded, students more actively involved at all stages). On the whole, however, the author believes that the experiences gained in Scandinavia should not be overlooked when experiments in medical education are undertaken in Britain or elsewhere.

Normal Psychology in the Preclinical Curriculum and the Student's Reaction to It. HAROLD BOURNE, D.P.M. The Lancet, Vol. II, August 29, pp. 195–199.

In 1956, at the Otago Medical School (New Zealand), a trial was made with weekly lectures in normal psychology for preclinical students in the 1st term of their 3d year, coinciding with the teaching of neuroanatomy and neurophysiology. Attendance was entirely optional, and at the end of each lecture a quarter of an hour was allowed for questions. The content of the course was limited by necessity: as an opening, the extensive scope of psychology was sketched, together with its main methods and a few detailed examples. Unconscious mental activity was then covered at some length, leading to Freud's theories on primary and secondary processes; inner sexual and aggressive pressures, and to the topics of motivation and drive, character traits and

psychic structure. Next, perception was discussed, which led to the body image, opening the subject of mental development. Finally, one lecture was devoted to intelligence and its measurements. In the following term, a questionnaire inquired into the students' views on the experiment. Of a class of 106, 99 replied. This paper describes their reactions as ascertained by the answers to the questionnaire, taking also into account the always lively, and sometimes heated, question period. The reaction of the students who attended was on the whole favorable, enough to encourage yearly repetition of the experiment. Over 80 per cent felt that teaching of psychology in the preclinical period should be increased. Some of the opinions voiced, however, especially as to the substance of psychology, revealed difficulties both with this and with scientific ideas in general; they showed that psychology itself stirs up a peculiar resistance to science in general, and a latent hostility to Darwinism (while the application of biological evolution to human anatomy is usually accepted, its application to human psychology is often resented). The unreliability of the senses for comprehending the natural universe (emphasized in all sciences) seems by no means taken for granted where psychology is concerned. Another difficulty was the massive preconception that nothing is firmly established in psychology and that the entire field is open to feud. Therefore, anything the instructor imparts might provoke partisan dispute (challenge may come from students who confess having been wholly unaware of psychology before, and who would not dream of opposing their teachers in other fields). It is suggested by the author (a lecturer in psychiatry at the University of Otago) that psychology—"the science of the behavior of living animals"—being part of biology, should begin to be taught, together with other medical sciences, in the second year, and should expand to a major subject with a formal examination. Instruction should be predominantly (though not entirely) in the hands of medical psychologists, who should be encouraged "to flower in medical schools," with departments and laboratories of their own.

On Medical Education. LESTER R. DRAGSTEDT, M.D., PH.D. Surgery, Vol. 46, No. 3, pp. 475–78, Sept., 1959.

These reflections on medical education center around two picturesque statements: one, by Robert Hutchins (then Chancellor of the University of Chicago), claims that *the Faculty is the chief obstacle in the way of a student getting an education*. The other, by A. E. Hertzler (in his book *The Horse and Buggy Doctor*) advocates that *researchers should be quarantined both for their own good and for the good of the student*, and that doctors "should be spared the agony of the scientific delivery room." These are statements of the opposite of what the author believes, since through experience he has become persuaded that an inspiring teacher is by far the most important factor in the educational system. The student should be brought into contact with such a man at the earliest possible time in his medical training, and deplorable is the recent practice in some universities of "sequestering our greatest figures in science in research institutes," where they come in contact only with graduate students. Having made a practice, for a number of years, of asking men unusually successful in medicine or science what factors in their estimation were chiefly responsible for their success, the author cites a few examples which give support to his point of view. As to teaching methods, he believes that the individual instructor should be given wide latitude; but, whatever method he may choose, the "priceless ingredients" of good teaching are enthusiasm for the subject and a sincere interest in the student. In his opinion, however, only the investigator is apt to have this enthusiasm and the ability to communicate it. He wholly agrees with Whitehead (*The Aims of Education*) who believes that for successful education there must always be a certain freshness in the knowledge dealt with

("knowledge does not keep any better than fish"); and who demands, for an efficient faculty, that "the two functions of education and research meet together in a university." With Whitehead, he also asks: "Do you want your teachers to be imaginative? Then encourage research." As to the controversial problem of the medical curriculum, the author admits certain reservations. He does appreciate that improvements can be made, but warns that, in making changes, great care must be taken not to stifle the research activities of the staff, not to destroy the morale of the teacher or to lessen his respect for the subject.

The Place of Science in Universities Past and Present. By the Right Hon. LORD ADRIAN, O.M., F.R.S. Nature, Vol. 183, pp. 1706–9. June 20, 1959.

In his address (delivered at the Rockefeller Institute Convocation, New York, May 21, 1959) Lord Adrian reviews the history of Gresham College (London), and discusses the part it played in the development of science in England. This college for advanced studies (named after its founder, Sir Thomas Gresham, the financial magnate who built the Royal Exchange during the reign of Queen Elizabeth), opened its doors 360 years ago to students both of arts and sciences (taught by seven professors—of music, rhetoric, divinity, law, physics, astronomy, and geometry). Gresham College, the author recalls, felt both the advantages and disadvantages of being located in the City of London, that is, at the heart of the seventeenth century struggle of Church versus State, the City being the central bastion of the Commonwealth in its fight with the King. After the Lord Protector had established his rule, some of the younger philosophers at Oxford and Cambridge were appointed professors at Gresham, but until the Restoration the City was still "an uneasy place for academic studies," and it was only after 1660, year of the foundation of the *Royal Society of London for Improving Natural Knowledge*, that the College enjoyed for a while the full advantage of its location. Gresham College's history is in fact largely the story of its connections with the Royal Society and its Fellows. Several large rooms were set aside in Gresham College for the Society's meetings, library, and curiosities; all kinds of experiments were demonstrated here to the Fellows, and several new instruments were made by Robert Hooke, the College becoming the focus for every kind of advancement in the Newtonian period. The College might have played an even larger part in the development of science if it had not suffered from the consequences of, first, the Great Plague of 1665, and, subsequently, of the Great Fire which hit London a year later. Finally, in 1703, when the Royal Society moved into a home of its own, Gresham College lost the immense advantage of its meetings and the company of its Fellows, and thereafter its history "takes on an XVIIIth century placidity." However, during its great period Gresham College, the author points out, had fully justified the hope of its founders and had been a truly great postgraduate center for scientific advance. During the 3 centuries which separate Gresham College in seventeenth century London from the Rockefeller Institute in twentieth century New York, the changes in scientific life, outlook and research have been too tremendous to permit a close comparison. When the philosophers met at Gresham College, they explored the whole world of nature, and they were as ready to learn about the ventilation of mines as to hear a discourse on the elasticity of the air. The majority of them were gentlemen of independent means who could please themselves, and the practical problems gave them new ideas on scientific principles as well as on useful arts. However, an important factor in slowing down the promising advance of the seventeenth century is seen in the lack of organized teaching in science and of students to be trained from the outset for a scientific career. Today, although it is still the prerogative of the universities to train young people for a career in the sciences,

and although academic scientists are aware of the need to study its foundations, there is the pressure of public demand for engineers and technologists, expected to bring immediate prosperity to their countries; and, in the medical sciences, for new discoveries to check the threat to our health and prolong our life span. There is, also, a still greater menace which comes from the great expansion of scientific effort at the university level: the danger that the centralized authority of the State will come to play a greater and greater role in directing the nature of university training, canalizing the advance in science and interfering to some extent with the processes by which we arrive at some entirely new outlook on outstanding problems. In today's universities, whereas it is considered highly desirable that science students be taught by senior staff themselves engaged in research, active research departments have often become too expensive and beyond the means of a university. It is often felt, by whoever pays for them, that results will come more quickly if the research is concentrated in a few well equipped institutes where it can go on uninterruptedly. The result has been a tendency to weaken the research activities of universities by removing some of the most fruitful fields of investigation to special institutes with little or no duty to teach. It is suggested that teachers should resist "too much paring down" of their responsibility of advancing knowledge within the framework of university courses, because the most fruitful research team will suffer in the long run if it has no direct contact with the student body, just as the student's general education will suffer "if it can never come near the growing points of knowledge." While it is inevitable that certain lines of research should be developed away from universities and classrooms (especially those concerning State and industry), the important point, in the author's view, is that universities be able to maintain active research departments in the kind of science which deals with general principles and offers no immediate profit to society.

A University of Graduate Studies. Dr. DETLEV W. BRONK, Nature, Vol. 184, pp. 86–87. July 11, 1959.

The President of the U.S. National Academy of Sciences and of the Rockefeller Institute comments in this address (delivered May 21, 1959, at the Rockefeller Institute Convocation) on the new responsibilities this Institute assumed when, 5 years ago, it founded its School of Graduate Studies. Its two most essential functions are (quoting from Rashdall of Oxford, the great biographer of European universities in the middle ages) "to make possible the life of study, whether for a few years or during a whole career"; "to bring together during that period face to face, in living intercourse, teacher and teacher, teacher and student, student and student." These objectives will sound familiar; their significance, however, may be less apparent, it is pointed out, to those who value academic institutions most or only from the training they gave as a preparation for specific tasks, and research only as discovery of useful knowledge. Too few, unfortunately, perceive research "as a happy, exciting adventure that gives vitality to our culture." The Rockefeller Institute wants to follow the advice its founder frequently voiced, not to be in a hurry to produce anything practical, but rather "explore and dream." Its purpose is to make the Institute a place in which to live a life of study, where students may come together, face to face, in "living intercourse." In order to preserve this intimate relation between scholar and scholar, the Institute will severely limit the number of its students, and, although the scope of universities is growing, with the increasing specialization, in order to satisfy the needs of a more and more complex civilization, in the author's opinion a graduate school may become superlatively good by *restricting* the scope of its endeavor to immediately related fields. The hope is expressed, finally, that the Institute's School of Graduate Studies may help to produce men such as the one Sir George Trevelyan (a Master of Trinity College, Cambridge) describes, speaking of

a friend, as "the specialist who has a wide outlook, broad knowledge, and warm enthusiasm outside his own subject as well as in it . . . whose mind has been trained in the splendid discipline of a science, but whose heart and eyes take also delight in the triumphs of art, in the history of man, in the beauties of Nature."

Required Student Research. Surgery, Vol. 46, No. 3, pp. 635–37. Sept., 1959.

Can research be made an integral and required part of the medical curriculum? This, we are told in this editorial, depends on the school, the faculty, and the student. Today, 25 per cent of American medical schools require a research or library project for graduation (an additional 11 per cent require the submission of an essay or thesis, not actually based on original research). For the adoption of a required program, expansion of neither classroom nor laboratory space is necessary if the faculty are actively engaged in research and if the facilities for it are adequate (an allocation of no more than $100.00 usually covers direct expenses of a student project). The essential requirement is time, which must be provided by an adjusted curriculum. To assure the support of student research by the school, it is also necessary that the authorities be concerned that the student destined to be a practitioner will profit quite as much from such a program as the one who will follow an academic career. As to the faculty, department heads seem to be nearly all in favor of student research (at least as an elective). However, if there is to be maximum benefit, the program becomes a time-consuming responsibility to faculty members and requires a high faculty to student ratio. Difficulties and frustrations may be largely compensated, on the other hand, by the intimate relationship and mutual respect that develop between faculty advisor and student who jointly attack a research problem. What does the graduate think of student research? Ebbert, after canvassing graduates from a school with a required student research program, found that 98 per cent looked back upon it as a valuable experience; 61 per cent were in favor of required research; two-thirds of those now engaged in full-time academic medicine believed that the thesis project influenced them in the selection of their career; 84 per cent of the graduates thought that it had helped them to judge the work of the others with more discrimination (cf. Ebbert, A., Jr.: *Retrospective Evaluation of Research in the Medical Curriculum* [to be published]). It is also pointed out that required research has worked well in a school with a medium-sized student body and a relatively large full-time faculty. However, if required research is not the answer for all schools, in those where such a program cannot be adopted, it is suggested that another plan be evolved to ensure an environment of research "practical for the administration and magnetic for the faculty and the student."

Scuola e Professione Medica in Italia (Medical Schools and Profession in Italy). ALBERTO BESTETTI and PAOLO LUCCHELLI. *In:* Avviamento alla Professione Medica, pp. 27–48, Milano-Roma, 1958.

Two young Italian physicians discuss, in this chapter of their work (on the "selection, control and orientation" of medical students in Europe and America), the teaching methods, requirements and organization of medical schools in Italy. There, the universities (all State-owned) enjoy administrative autonomy, but the curricula of all Faculties (including that of Medicine) are subject to approval by the Secretary of Education (*Ministero della Publica Istruzione*). The reform project of 1951 (never made into law because of the fall of the Italian Government at that time) provided an important modification of the general orientation of university teaching: a differentiation, within the same Faculty, of courses directed toward professional education from those directed toward scientific research. While this reform project was wel-

comed, at the time, by some Faculties (especially Law and Letters), it raised strong opposition from medical schools, on the ground, among others, that it would be too difficult a task for a medical Faculty to divide its forces in that way. Medical educators in Italy rather adhere to the conclusions, reached at the London Convention of 1953, that medical schools must strive to provide for their students, within the limited period of study, the basic preparation necessary for the later development of the general practitioner, the specialist, teacher, or research worker. As to this last category, the education for medical scientific research presents, as the authors point out, a particularly complex problem which, involving other Faculties, cannot be solved by the medical schools alone (as has been clearly stated by the 1954 London Conference of the Council of the Intern. Organization of Science). At present, instruction in medicine and surgery is offered in Italy in 21 University Faculties.

A diploma from either the *Liceo Classico* or the *Liceo Scientifico* is sufficient for admision to a Faculty of Medicine (in Italy, as elsewhere, efforts are under way to improve premedical education, especially the deficiencies of science teaching in high schools). Medical education at the university level lasts 6 years. After the first year's "preparatory" courses in general physics, chemistry, and biology (and more strictly medical subjects such as histology and embryology), the curriculum includes a series of 2-year courses in human anatomy (1st and 2d years); special medical pathology and special surgical pathology (3d and 4th); pathological anatomy (4th and 5th); general clinical medicine and general clinical surgery (5th and 6th). Teaching of other subjects is distributed throughout the study years in relation to the progressive formation of the "basic" medical education. Considerable time is devoted to specialized clinical work. The required minimum of 50 lecture hours per year for each course is now surpassed in most schools. Before World War II, an equal number of practical exercise hours was added to the total number of lecture hours, but these have been reduced now because of the excessive number of students. (It must also be noted that practical medical instruction is far more reduced in Italy than in other countries.) After the 6 years of study and successful examination, the doctor's diploma is granted on the presentation of a written dissertation (followed in some schools by oral "defense"), after which a 6-month hospital internship is required before the State Examination, which licenses the newly qualified doctor for practice is taken. A statistical analysis of the student body for 1955–56 presents detailed figures on the medical student population in all 21 institutions, the total enrollment numbering 28,250 (13 per cent of the total enrolled in all Faculties); average enrollment was 1345 medical students per school (compared with an average of 340 in American medical schools). The teaching staff included 696 professors and 6242 assistants. The number of women studying medicine has considerably increased during the last decade (now a 12 per cent of the total). As to the actual situation of the medical profession in Italy, there is a constant increase in the number of newly qualified doctors, and, while their geographical distribution is uneven, the authors assert that the ratio of practicing physicians per number of inhabitants has already reached the saturation point and that "the prospect of obtaining in their country a fair professional retribution is becoming more and more uncertain for Italian doctors."

NEW BOOKS

KENNETH E. PENROD
Book Review Editor

Abstracts

Gray's Anatomy of the Human Body. Edited by CHARLES MAYO GOSS. 27th ed. Philadelphia: Lea & Febiger, 1959. 1406 pp., 1174 illustrations. $17.50.

This is the American centennial edition of this classic treatise in anatomy. Much revision has taken place in this edition. The chapter on the central nervous system has been completely rewritten, simplified, and reduced in length by 50 pages. The cardiovascular system has been split into three parts: the heart, the arteries, and the veins, each with its own section on embryology. The logical plan of having embryology first and histology last in the different chapters and sections has been followed throughout. Other changes in this edition include the addition of new illustrations on various parts, notably in the sections on the skin and on the liver. The "ductless glands" have been named the "endocrine glands" and their description expanded and brought up to date. The new Paris nomenclature has been adopted throughout the book with a few unavoidable exceptions, particularly where changes would be of little significance and would involve considerable expense in relabeling figures. As in the last edition, references to original articles have been included in newly written parts of the text. The editor wishes that all users of the book would realize that details of anatomy not included in the text are almost always to be found in one of these references, because they have been deliberately chosen with this in mind.

Clinical Auscultation of the Heart. By SAMUEL A. LEVINE and W. PROCTOR HARVEY. 2d ed. Philadelphia: W. B. Saunders Co., 1959. 637 pp., 660 illustrations. $11.00.

The ten years that have elapsed since the 1st edition of this book have afforded the authors an opportunity to increase the scope of the book. Numerous additional ausculatory phenomena have been observed, studied, and illustrated, examples of which were not available or not known previously. Greater experience with congenital heart disease has broadened the knowledge of the significance of certain murmurs and sounds, especially splitting of the second sound. Variations of the physical findings in different patients suffering from the same underlying condition have often necessitated the inclusion of more than one illustration of the ausculatory phenomena in question. In general, it has become clear that, despite the aid and advances that have come from the newly introduced more specialized techniques of cardiac investigation, the value of the simple stethescope is steadily increasing.

Psychiatry in the Medical Specialties. By FLANDERS DUNBAR. New York: McGraw-Hill Book Co., Inc., 1959. 469 pp.

It has been found that at least 65 per cent of patients are suffering from illness syndromes initiated or seriously complicated by psychological problems; yet a relatively small proportion of physicians have had sufficient training in psychiatry to equip them to treat this 65 per cent of their patients. Even a smaller proportion have time to keep abreast with developments in psychiatry pertaining to their specialties. For a physician trained in a given specialty, it is not easy to keep close contact with changes taking place in other specialties, even those closely linked with his. In view of these facts the author has attempted to outline and illustrate the contribution of psychiatry to the diagnosis and treatment of illness syndromes most frequently encountered by each specialist —diseases responsible for the major mortality, morbidity, disability, and social incapacity as they appear now. The patient population highlights that most baffling of all "diseases," old age. Attention is given therefore to the syndrome of longevity. Strong emphasis is placed on the problems of differential diagnosis as they are encountered in specialties and in the problem of aging. The book first discusses the changing concepts of disease, then

the history of the patient, his illness, the illness syndromes, and the therapy. In this book psychiatry is presented as the tree for the branches of medicine. The book attempts to stimulate cross fertilization of thinking by improving communications among specialists in medicine and the medical sciences.

Experimental Surgery. By J. Markowitz, J. Archibald, and H. G. Downie. 4th ed. Baltimore: The Williams & Wilkins Co., 1959. 907 pp. $12.50.

Experimental surgery is physiology, as created by the tools of the surgeon. As such it is an important constituent of comparative medicine. The authors, all of Ontario Veterinary College, have exhibited rare skill in blending the specialized knowledge of the anatomist, the biochemist, the physiologist, and the pathologist, and they have created experimental surgery as a distinctive and comprehensive subject. It has been 22 years since the 1st edition of this book was published. It is written not only for the surgeon but also the graduate and undergraduate student of surgery and physiology. It will likewise be helpful to the specialist needing a reference book of information—established and new—and those fortunate enough to be engaged in collaborative efforts in human medicine and veterinary medicine. The book has been heavily revised, with new material being added in the form of chapters on the prostate gland, hypothermia, and the elementary experimental surgery of the central nervous system. Many other sections of the book, too numerous to be singled out, have been modernized.

Clinical Disorders of Hydration and Acid-Base Equilibrium. By Louis G. Welt. 2d ed. Boston: Little, Brown & Co., 1959. 283 pp. $7.00.

This monograph is an attempt to examine the pathogenesis and treatment of disorders of fluid and electrolyte metabolism with reference to what is known and what may reasonably be inferred concerning the mechanisms that are responsible for the maintenance of normal volume, tonicity, composition, and pH of body fluids. The author presents several reasons for a 2d edition: there have been significant advances in some of the fields which are discussed; a new chapter has been incorporated dealing with the special problems presented by the pediatric age group; and, lastly, he feels he has learned to present some of this material more precisely and more clearly than he did 4 years ago.

Essential Principles of Pathology. By John W. Landells. Philadelphia: J. B. Lippincott Co., 1959. 271 pp.

A sound knowledge of pathology has become more than ever necessary to the understanding of the clinical manifestations of disease, and this book is designed to give the beginner that essential knowledge of the subject that he must gain as quickly as possible when starting clinical medicine. The etiology of most diseases is complex, and the only hope of understanding them is to look at them not in "splendid isolation" in the ward, or in one laboratory department, or from one point of view only, but simultaneously from many different angles. Only so is it possible to synthesize a concept of what is really happening in the body-mind of a particular person and really understand the nature of his or her disease. Dr. Landells approaches the problem of disease primarily from the angle of morbid anatomy, but throughout this book he emphasizes the correlation of knowledge so gained with knowledge derived from other scientific sources and shows the reader how to weld the teaching he gets in so many scientific departments into a coherent concept of disease as a whole.

Clinical Scalar Electrocardiography. By Bernard S. Lipman and Edward Massie. 4th ed. Chicago: The Year Book Publishers, Inc., 1959. 438 pp. $8.00.

In this 4th edition the authors have tried, in spite of the many changes and additions, to apply the same principles of simplicity and practicality that were utilized previously, keeping in mind that this book is intended primarily for those who are beginners and for those who are relatively inexperienced in the field of electrocardiography. The complex body of information contributed by many specialists from a variety of backgrounds, involving physical mathematical principles and laws, is complicated and beyond the scope of the average clinical physician. Some knowledge of this material and its application, however, is important to the person who interprets electro-

cardiograms in order to replace as much as possible the empiric approach to electrocardiography. In this edition the more important fundamental theories and concepts have been presented, whether controversial or not, trying to present them briefly and as simply and in as uncomplicated fashion as possible. The basic format of this 4th edition has not been changed; adherence is still made to the teachings of the three pioneers in the field of electrocardiography: Einthoven, Lewis, and Wilson. Their original principles have been changed slightly to bring them up to date. Various electrocardiographic conditions attracting attention have been added, some of which are controversial. Numerous excellent articles, reviews, and books have been added to the bibliography. All in all, a very thorough revision of the previous edition has taken place.

A Guide to the Identification of the Genera of Bacteria. By V. B. D. SKERMAN. Baltimore: The Williams & Wilkins Co., 1959. 210 pp. $5.50.

This paper-backed edition is divided into three major parts: a comprehensive key to the genera of bacteria, digest of genera, and methods. The key has been compiled with the aim of placing in the hands of research workers, teachers, and students a volume in which general directives for the identification of bacteria are supported by a complete list of the techniques needed for the purpose. In addition, a digest of data published for the various species in the 7th edition of *Bergey's Manual of Determinative Bacteriology* and in several original papers has been included. The publication of the key and methods in the one book should encourage a more general application of common procedures for the description of bacteria. The main purpose of the digests is to draw attention in a more definite way to the deficiencies in descriptions within the various genera in the hope that steps may be taken to rectify them. A guide to study has been provided to ease the burden associated with assimilation of knowledge over this varied field of science. The volume is intended as a supplement to the *Manual* itself, and it is hoped that its use will contribute materially to the development of future editions of the *Manual*.

Anatomy and Physiology. Edited by EDWIN B. STEEN and ASHLEY MONTAGU. College Outline Series, Vol. 2. New York: Barnes & Noble, Inc., 1959. 282 pp. $2.50.

This is the second of two volumes in the familiar paper-back College Outline Series. In the first volume of Anatomy and Physiology the following topics were covered: cells and tissues, integument, skeletal, muscular and digestive systems; blood, lymph, and the circulatory system. In the second volume the following systems are covered: urinary, respiratory, nervous, special senses, endocrine and reproductive. The two volumes are designed both for initial survey and for review of the subject.

A Doctor's Life of John Keats. By WALTER A. WELLS. New York: Vantage Press, 1959. 247 pp. $3.95.

It is not generally known that John Keats, the poet, was also a practitioner of medicine. His experiences in medicine were necessarily brief, for his entire accomplishments in life were crowded into a busy 26 years. He trained in the usual apprentice fashion and later spent a year and one-half as a student of medicine in Guys Hospital School of Medicine in London. Later, however, he abandoned medicine entirely for his writing. During his brief life as a poet, however, his own health progressively failed, bringing about his early demise. The life story of this young physician-poet has been prepared not only for doctors but for lay consumption as well.

NEWS FROM THE MEDICAL SCHOOLS

Alabama

Dr. E. CARL SENSENIG, professor of anatomy, has been appointed chairman of that department, succeeding Dr. JAMES O. FOLEY, resigned. Dr. Foley will continue as professor of anatomy. Before coming to Alabama in 1941 as instructor in anatomy, Dr. Sensenig held teaching positions at Johns Hopkins and Tulane University Medical Schools. Named to full professorship in 1952, he now heads a department which instructs dental and medical students in both the undergraduate and the graduate programs.

George Washington

International honors were accorded Dr. WALTER A. BLOEDORN recently as he was decorated by the Government of Panama, with the medal of the Order of Vasco Nunez de Balboa. Dr. Bloedorn, emeritus professor of medicine and dean of the School of Medicine until 1957, received the medal at ceremonies in the George Washington University Hospital. The decoration saluted Dr. Bloedorn's contribution to the health of the people of Panama through his service as president of the Gorgas Memorial Institute. It also recognized the fact that it was during his regime as dean of the GW School of Medicine that some of Panama's most distinguished physicians trained there.

Hahnemann

Ceremonies for the newly reconstructed animal colony for medical research were held recently with its benefactor, William Goldman, officiating. Cost of the facility is $34,000. The three-story structure will house laboratory animals in use in Hahnemann's $1.1 million research program, which covers more than 97 projects centered mainly in heart disease and cancer.

Harvard

Dr. MANFRED L. KARNOVSKY, associate professor, has been named acting head of the department of biological chemistry, filling the vacancy created by the resignation of Dr. ERIC G. BALL. Dr. Ball, who has served as acting head of the department since December 1958, recently returned from England where he participated in the second annual meeting of the Association for the Study of Medical Education. He is chairman of the division of medical sciences. Dr. Karnovsky came to the United States from Johannesburg, South Africa, in 1947 and joined the Harvard Medical School in 1948 as a research fellow in the department of biological chemistry.

Illinois

Dr. WARREN H. COLE, professor and head of the department of surgery, took over the reins as president of the American Cancer Society at its annual meeting in New York. He succeeds Dr. EUGENE P. PENDERGRASS of the University of Pennsylvania.

Indiana

A two-year education program for young physicians aspiring to the role of "family doctor" and desiring more clinical experience than a routine hospital internship, has been developed by the School of Medicine. The new program follows suggestions of the American Medical Association and the American Academy of General Practice for such training but differs from any similar programs now offered. It will be a separate entity from the regular internship and residency program groups and the basic responsibility for the administration of the training aspects will fall within the department of medicine.

3 *Modern Mosby Texts to Recommend to Students*

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By JOHN A. PRIOR, M.D.; and JACK S. SILBERSTEIN, M.D. New. 1959, 388 pages, 6¾" × 9¾", 193 illustrations. Price, $7.50.

New 3rd Edition Moseley
TEXTBOOK OF SURGERY

Because visual aid in the teaching of surgery is so important, 167 black and white and 30 full color illustrations have been added to the new 3rd edition of Dr. H. F. Moseley's TEXTBOOK OF SURGERY. The text is completely revised, expanded and brought up-to-date to include many of the most recent advances in this specialty. Sections on surgery of the heart, great vessels and lungs have been completely rewritten. This book discusses important principles of clinical background and gives "reasons why" certain procedures are followed.

Edited by H. F. MOSELEY, M.A., D.M., M.Ch. (Oxon), F.A.C.S., F.R.C.S. (Eng.). Written by 40 eminent contributors. New. 1959, 3rd edition, 1336 pages, 6⅞" × 10", 738 text illustrations, 108 color plates. Price, $17.00.

10th Edition Bard
MEDICAL PHYSIOLOGY

There is good reason why the 10th edition of MEDICAL PHYSIOLOGY continues as one of the more popular books in the preclinical curriculum among both teachers and students alike. Many medical educators have proven for themselves that its excellent pedagogical approach and its broad, better balanced coverage of physiology make it the best text they can choose for their students. They know, too, the additional value of its modern biochemical approach and its complete bibliography. Although it is a large, comprehensive volume, students like its easy-to-read style and the way in which it clarifies the application of physiology to the clinical practice of medicine.

Edited by Philip Bard, Professor of Physiology, School of Medicine, The Johns Hopkins University. With 13 collaborators. 1956, 10th edition, 1421 pages, 6¾" × 9¾", 438 illustrations, 5 in color. Price, $14.00.

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According to Dr. W. DONALD CLOSE, medical director of the University hospitals and head of the Medical School's postgraduate activities, the Indiana program is a pilot study in a new phase of medical education. Purpose of the program is to provide a more intensive background of experience for the trainee in the diagnostic and treatment problems which will be encountered among patients of all ages when he establishes his own office.

Johns Hopkins

Dr. ALLAN CAMPBELL BARNES of Western Reserve University, has been appointed professor and director of the department of gynecology and obstetrics in the School of Medicine and gynecologist and obstetrician-in-chief of the hospital. Dr. Barnes will begin his official association with Johns Hopkins on July 1. He will assume the posts to be vacated by Dr. RICHARD W. TELINDE, professor of gynecology and gynecologist-in-chief, and Dr. NICHOLSON J. EASTMAN, professor of obstetrics and obstetrician-in-chief, when they retire. Dr. Barnes is now professor of obstetrics and gynecology at Western Reserve where he has served since 1953. He is also director of MacDonald House, the women's hospital of the University Hospitals in Cleveland. During his academic career, he has also held senior teaching posts at the Ohio State University College of Medicine and the University of Michigan Medical School.

Kansas

Dr. ROBERT P. HUDSON has been appointed assistant dean in charge of student affairs at the School of Medicine. A graduate of the University of Kansas, Dr. Hudson received his M.D. there in 1952. Following completion of his residency in 1958, he became an instructor in the department of medicine and was promoted to associate in medicine in July 1959.

Dr. JOHN R. CARTER, formerly of the University of Iowa, has been named professor of pathology and chairman of the department. Taking over his duties January 1, Dr. Carter fills the post held for over ten years by Dr. ROBERT E. STOWELL, who is now scientific director of the Armed Forces Institute of Pathology in Washington. Dr. Carter earned the M.D. degree from the University of Rochester, and took his internship and residency at the University of Iowa. He joined Iowa's faculty of medicine in 1944 as an instructor in pathology.

Maryland

The university's board of regents announced the appointment of Dr. EUGENE B. BRODY as chairman of the department of psychiatry and director of The Psychiatric Institute. Dr. Brody joined the faculty in 1957 as professor of psychiatry and was appointed psychiatrist-in-chief to University Hospital and The Psychiatric Institute in 1958. Since the death of Dr. JACOB E. FINESINGER in June 1959, he has been acting chairman of the department and acting director of the Institute. Before coming to Maryland, he was associate clinical professor at the Yale University School of Medicine, where he also received his graduate training in psychiatry after receiving the medical degree at Harvard Medical School in 1944.

Michigan

A new training program titled, "Research in Medical Care" is being offered to graduate students by the University's School of Public Health. Supported by a five-year grant from the Ford Foundation, the program is designed chiefly to train graduates in the effect of social factors on the health care of the aged. A limited number of paid research assistantships are available to students with a background in public health, social work, economics, sociology, and certain other social sciences.

Minnesota

The Public Health Service has awarded $100,560 to the University of Minnesota to support 1960 training programs for research scientists. Staff members sharing in the awards are Dr. JOHN A. ANDERSON, profes-

sor and head of the department of pediatrics, $58,016 for a training program in research pediatrics; Dr. RALPH L. KITCHELL, professor and head, department of veterinary anatomy, $27,732 for a training program in anatomy; and Dr. SHELDON C. REED, professor and director of zoology, $14,821 for a training program in human genetics.

Missouri

Dr. FRED V. LUCAS will join the faculty of medicine July 1, as professor of pathology. He is presently in the pathology department at Columbia University College of Physicians and Surgeons.

North Carolina

Five new faculty appointments have been made in the UNC Division of Health Affairs—four in the School of Medicine and one in the School of Public Health. Coming from the University of Texas School of Medicine is Dr. DORIS C. GROSSKREUTZ, who was named associate professor of surgery in anesthesiology; Dr. ESZTER KOKAS became assistant professor of physiology. Educated at the University of Debrecent in Hungary, Dr. Kokas' most recent appointment was with the Catholic University of Cordoba in Argentina. Dr. MILTON L. MILLER, formerly of the department of psychiatry of the Los Angeles County General Hospital, has been appointed professor of psychiatry. Dr. MORRIS A. LIPTON joined the faculty as associate professor of psychiatry, having served with the Veterans Administration Hospital in Chicago. Dr. BERNARD S. PASTERNACK was named an assistant professor in the School of Public Health, where he has been a research fellow.

Oregon

The first full-time head of the division of gastroenterology and an occupant to fill the Oregon Heart Association chair of cardiovascular research are among the new faculty appointments. Dr. JOHN A. BENSON, Jr., has received the gastroenterology post with the rank of associate professor of medicine. He is a graduate of Harvard Medical School, where he was recently a member of the faculty. Dr. GEORGE B. LONG, formerly acting division head, is continuing on the faculty as an associate clinical professor. Dr. JAMES METCALFE, also a Harvard graduate and faculty member, has accepted the Heart Association chair, which was established to enlarge the scope of cardiovascular research and training. Dr. Metcalfe will take up his duties in July 1961, following a year of study and research at Tubingen University Medical School in West Germany.

Pennsylvania

Dr. PAUL NEMIR, Jr., associate professor of surgery in the Graduate School of Medicine, and assistant professor of surgical research in the School of Medicine, has been elected dean of the Graduate School of Medicine. He succeeds Dr. GEORGE B. KOELLE, who resigned to accept the position of professor and chairman of the departments of pharmacology in both schools. Dr. Nemir's first faculty appointment in the School of Medicine was in 1948 as instructor in surgery. In 1955 he was appointed an associate professor in the Graduate School of Medicine and that same year he also was appointed an assistant professor in the Medical School's department of surgical research. In addition to his teaching and research activities, Dr. Nemir is attending surgeon to the University of Pennsylvania Service of the Veterans Administration Hospital in Philadelphia, and is consultant in vascular surgery at the U.S. Naval Hospital.

Puerto Rico

Announcement has been made of the appointment of Dr. CONRADO F. ASENJO as assistant dean of the School of Medicine. Dr. Asenjo is professor and head of the department of biochemistry and nutrition.

Rochester

The university recently launched its new $400,000 Radiation Center at Strong Me-

morial Hospital, University Medical Center, with a series of open houses. Designed for diagnosis, therapy, teaching and research in the problems of cancer and related diseases, the Radiation Center will serve a population of about one million persons in Western New York. According to university sources, the most modern radiation machines for treatment of disease have been installed, including two supervoltage X-ray devices—a two million electron volt Van de Graaff generating unit, and a Cobal rotational unit emitting radiation of between one and two million volts. Now housed in its own new building, the Center also has two conventional orthovoltage 250 kilovolt range machines and a 140 kilovolt X-ray generator for treating superficial lesions.

Dr. PHILIP RUBIN, chief of the division of radiation therapy, is director of the Radiation Center, and Dr. GEORGE H. RAMSEY is chairman of the department of radiology, under which the division functions.

Seton Hall

The Rt. Rev. Monsignor JOHN J. DOUGHERTY was installed as President of Seton Hall University at services held December 1. Monsignor Dougherty graduated from Seton Hall University, later attending the North American College in Rome. He received his licentiate in sacred theology from Gregorian University and was awarded the licentiate in Sacred Scripture from the Pontifical Biblical Institute. His work in TV and radio won him an international film award and TV awards. He inaugurated the Institute of Judeo-Christian Studies located at Seton Hall.

Dr. CHARLES L. BROWN, dean of Seton Hall College of Medicine and Dentistry since 1955, died December 4, 1959. Prior to his appointment at Seton Hall, Dr. Brown had taught at Temple University School of Medicine as professor of medicine, and had served as dean of Hahnemann's Medical College from 1946 to 1955.

S.U.N.Y. Upstate

Dr. JAMES B. PRESTON will become professor and chairman of the department of physiology next July 1, upon the resignation of Dr. GORDON K. MOE, who is leaving the Center to become Laboratory Director of the Masonic Foundation for Medical Research and Human Welfare in Utica, N.Y. Dr. Preston joined the Medical Center in July 1956, as instructor in physiology and was promoted to assistant professor in 1956. Since that time he has been actively engaged in neurophysiological and neuropharmacological research. He earned his M.D. degree at the Illinois Research and Educational Hospitals in Chicago, and during his internship he also served as instructor in the department of pharmacology, University of Illinois.

Tulane

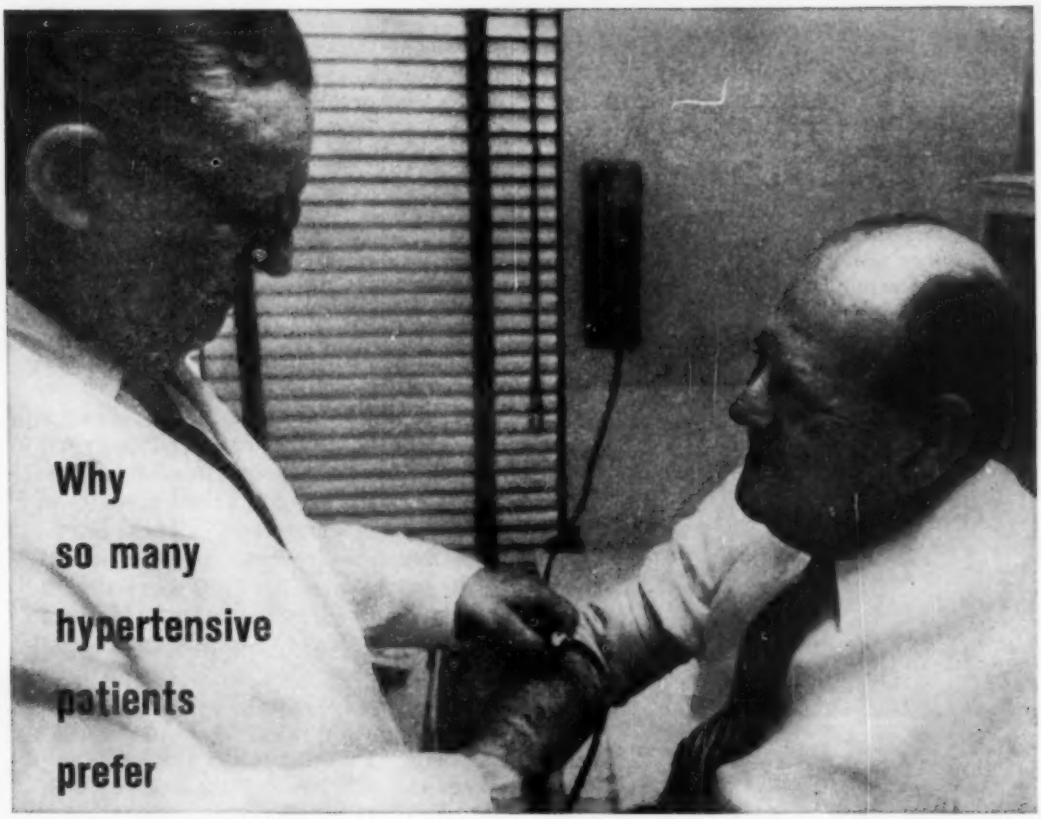
Dr. HERBERT E. LONGENECKER, vice president of the University of Illinois in charge of its Chicago professional colleges, will become president of Tulane University, effective September 1, 1960.

Dr. Longenecker came to the University of Illinois in his present post in 1955 from the University of Pittsburgh where he was dean of the Graduate School. He earned a bachelor of science degree, master of science, and doctorate from Pennsylvania State University. He then went abroad on a National Research Council fellowship to study biological sciences, studying at the University of Liverpool. He became a research professor at Pittsburgh University in 1938. By 1944 he was dean of research in the natural sciences and two years later, he additionally was named dean of the Graduate School. In 1944, for his work in biochemistry, he was cited one of the "ten ablest chemists or chemical engineers" in the country.

Dr. Longenecker succeeds RUFUS C. HARRIS, retiring as Tulane's president after 22 years there.

Vermont

The Medical School has announced the addition of five new members to its faculty.



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*Herrmann, G. R., Vogelpohl, E. B., Hejtmancik, M. R., and Wright, J. C.: J.A.M.A. 169:1609 (April 4) 1959.

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Coming from the California State Department of Health where he was medical officer of the Viral and Rickettsial Disease Laboratory, Dr. JAMES O. CULVER joined the faculty as assistant professor of preventive medicine. Dr. MOSES A. HAYNES was appointed assistant professor of preventive medicine. He was formerly medical officer in charge of the Public Health Service, Indian Hospital, Cheyenne Agency, South Dakota. Dr. JULIUS H. JACOBSON, formerly at Columbia University, was named associate professor of surgery. The newly created position of associate professor of radiologic physics in the department of radiology has been assigned to Dr. CLINTON D. JANNEY. Dr. Janney has taught at the University of Iowa and was senior physicist at the Southwest Research Institute, physics department, San Antonio, Texas. He also served as associate cancer research scientist at Roswell Park Memorial Institute, anesthesiology department, Buffalo, N.Y. A former assistant resident in pathology at Yale joined the faculty as assistant professor of pathology. Dr. BERT K. KUSSEROW assumed this position at Vermont October 1, 1959.

Wisconsin

Dr. CHARLES W. COTTERMAN will join the Wisconsin medical faculty February 1, as professor of medical genetics. Dr. Cotterman has been professor of genetics and biometry, Graduate Research Institute of Baylor University.

Dr. J. E. ROSE, associate professor of physiology and psychiatry, the Johns Hopkins University School of Medicine, will come to Wisconsin as professor of Neurophysiology, July 1. He succeeds Dr. KONRAD AKERT, who recently was appointed professor of neuroanatomy in the department of anatomy.

Yale

With a grant of $591,000 from the Commonwealth Fund for construction of a 449-seat auditorium at the Yale School of Medicine, groundbreaking for the new structure is expected to take place this winter with an anticipated completion date of January 1,

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SO MUCH A PART OF HER ACTIVE LIFE

1961. The building will be named the Mary S. Harkness Memorial Auditorium after the wife of the late EDWARD S. HARKNESS, Yale '97, one of the university's greatest benefactors and the man who was President of the Commonwealth Fund until his death in 1940. Mrs. Harkness was Honorary President of the Fund from 1940 until her death in 1950. To be located in a courtyard of the Sterling Hall of Medicine, the auditorium will be used for assemblies, lectures, demonstrations, and conferences, not only for local doctors and students, but also for regional and national medical meetings. The interior has been designed and will be equipped to meet special acoustical requirements—taking into consideration audience participation. Anyone speaking from the audience may be heard throughout the auditorium without the use of a microphone. The building will also have conduits for closed-circuit televising of operations and other activities of the medical center.

Professor IRA V. HISCOCK retired from his position as chairman of the Yale public health department on January 1. A member of the Yale faculty for 40 years, Dr. Hiscock has been the Anna M. R. Lauder Professor of Public Health since 1945. Although not due to retire officially until June 30, he is being granted leave by the university to assume a Carnegie Visiting Professorship in Public Health at the University of Hawaii in Honolulu.

Upon Dr. Hiscock's retirement, Dr. ANTHONY MONCK-MASON PAYNE, epidemiologist from Great Britain, will become the Anna M. R. Lauder Professor of Public Health and chairman of a reorganized department of epidemiology and public health. Dr. Payne, who is now chief medical officer for endemo-epidemic diseases of the World Health Organization in Geneva, will assume his new duties July 1. According to university officials, the new appointment marks a major reorganization within the School of Medical whereby the public health department will be combined under Dr. Payne with the collaboration of Dr. JOHN R. PAUL of Yale, investigator in the field of poliomyelitis and other infectious diseases.

ITEMS OF CURRENT INTEREST

AAMC Offering Foreign Fellowships

The opportunity to gain an understanding of medicine as practiced in remote areas of the world while unofficially furthering international relations for the United States, is being offered to medical students by the Association of American Medical Colleges through fellowships established by the Smith Kline & French Pharmaceutical Company.

The $180,000 grant from SKF will provide selected medical students with a broad clinical experience, an understanding of preventive medicine as practiced abroad, an opportunity to study diseases not common to the United States, and a definite awareness of the acute need for American physicians and their medical knowledge abroad. In addition, this opportunity will afford the selected Fellow the chance to play the role of individual ambassador or missionary. He will be representative of the method of medical education in the United States while communicating the most recent medical science to distant areas of the world.

Any student who has completed his third year of medical school is eligible to apply for a fellowship. If accepted he may spend 12 weeks or more at a foreign mission or other remote private medical facility or remote public health unit, clinic or hospital. Awarding of a Fellowship will be determined on the basis of the applicant's ability, potential and his objectives in wanting to study abroad. Emphasis will be placed on the applicant's plan for study and experiences which would not be afforded to the applicant at a medical school here in the

United States and through which the student will bring back significant knowledge to this country. Cash awards will be made on an individual basis. The amount will vary, commensurate to the estimate of costs and individual needs. Allowances will be made for a wife providing her objectives are in line with some service work such as teaching or missionary work.

At the termination of time spent abroad, a Fellow is expected to write a report summarizing his clinical experiences abroad, including his personal evaluation of the effectiveness of the trip as a part of his medical education.

Medical students who wish to apply for a Fellowship must submit their application to the dean of their medical school. If acceptable, he in turn will endorse same and forward it to the Selection Committee at the Association of American Medical Colleges.

Eisenhower Appoints Van Dellen and Wells to Library Board

President Dwight D. Eisenhower has appointed Dr. Theodore R. Van Dellen, assistant dean of the Northwestern University Medical School, and Dr. Warner Wells, associate professor of surgery, the University of North Carolina School of Medicine, to the board of regents of the National Library of Medicine.

The library was established in 1956, and a $10 million building to house it is being built in Bethesda, Md. It will include the armed forces medical library, in which all federal agencies place their medical files, and which has been described as the largest medical library in the world.

AHA and AMA Collaborate on Health Care Program for Needy

The Board of Trustees of the American Hospital Association and the American Medical Assocation, in a joint resolution, announced they will mobilize their full resources to accelerate the development of adequately financed health care programs for needy persons—especially the aged. The resolution made it clear that both organizations will stimulate their state and local components to work with local government toward adequate financing of high quality health care for the needy supported by all community resources and necessary tax funds.

While the resolution stated that provision of health care to "the indigent or near indigent is primarily a community responsibility," and the boards of trustees are aware that effective medical care programs for needy persons are already established in some states and local communities, they have taken this joint action because of their conviction that such programs deserve increased support and stimulation. Too, such proposals as the Forand Bill are not designed especially to assist the needy, since they apply to all social security beneficiaries and exclude the majority of needy persons who are not eligible for social security benefits.

Animal Care Panel Convention Held

More than 600 medical investigators, supervisors of laboratory animal colonies, veterinarians, animal caretakers, technicians, animal breeders, and laboratory equipment suppliers from the United States, Mexico, Canada, and Great Britain, attended the 10th Animal Care Panel Convention in Washington, D.C., recently. Discussions centered on genetics, housing and management, nutrition, equipment, technique and facilities, germfree and specific pathegen free animals, and diseases.

Highlighting the meeting was the presentation of the 1959 Charles A. Griffin Award to Dr. Robert D. Henthorne in recognition of his work in promoting and developing high standards for the production and use of disease-free animals. Dr. Henthorne is Chief of the Animal Laboratory Division of Microbiological Associates, Inc., of Bethesda, Md. The Griffin Award, honoring the late Charles A. Griffin, veterinary bacteriologist at the New York State Department of Health Laboratories in Albany, N.Y., who devoted much of his career to developing colonies of laboratory animals free of many

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serious infectious diseases, is presented annually to the person who most significantly advances the concepts of improved laboratory animal quality.

National Foundation Announces New Fellowship Program

The first fellowship program to provide training for medical students specifically in genetics and embryology has been announced by Basil O'Connor, president of The National Foundation. According to Mr. O'Connor, the program will help prepare the scientists desperately needed in fields which are basic to The National Foundation's expanded research program in birth defects and arthritis.

Under the new fellowship program, which became effective Jan. 1, every approved medical school in the country may nominate one student who wishes to undertake a research program in genetics and embryology. The student must have completed at least one year of medical school and be able to devote a minimum of eight weeks consecutively to full-time research. The stipend for these fellowships is $600.

Avalon Grant to Practical Nursing

The National League for Nursing has received a grant of $100,000 from the Avalon Foundation, New York, for the extension of services to schools of practical nursing. The grant is for a four-year period. The funds will make it possible for the League to initiate a study of schools of practical nursing and to sponsor regional conferences for teachers in practical nursing as part of its school improvement program.

American College of Physicians Names Executive Director

Dr. Edward C. Rosenow, Jr., of Los Angeles, Calif., took over as Executive Director of the American College of Physicians on January 1. He succeeds Edward R. Loveland, who retired December 31, after nearly 34 years of service as the Executive Secretary of the College. Dr. Rosenow has held teaching positions at the College of Medical Evangelists and the Universities of Southern California and California (Los Angeles) Schools of Medicine.

Dr. Van Slyke to Retire from NIH

Dr. C. J. Van Slyke, Deputy Director of the National Institutes of Health, is retiring after some thirty years' service in the Public Health Service Commissioned Corps. In announcing the retirement, Dr. John D. Porterfield, Acting Surgeon General of the Public Health Service, praised Dr. Van Slyke for his many outstanding contributions to the field of public health and to medical research administration.

Dr. Kenneth M. Endicott, presently Associate Director (for training programs) will be given additional responsibilities involving the grants program.

PERSONNEL EXCHANGE

Faculty Vacancies

ANESTHESIA RESIDENCIES: Announcing four appointments for residency in anesthesiology in approved department of anesthesia, University Hospitals of Cleveland, Ohio, beginning January 1, 1960, for graduates of approved medical schools or ECFMG-qualified applicants. Additional appointments for July, 1960. Stipend and other information may be obtained by writing Robert A. Hingson, M.D., Director of Anesthesia, University Hospitals of Cleveland and Professor of Anesthesia, Western Reserve University School of Medicine, 2065 Adelbert Road, Cleveland 6, Ohio.

PHARMACOLOGIST: Ph.D. Position available in a medical research institution devoted entirely to research work. Current problems deal with hematopoietic mechanism and arteriosclerosis. No immediate teaching, but possibility in the future if interested. Write to: Director, Toledo Hospital Institute of Medical Research, 2805 Oatis Avenue, Toledo 6, Ohio.

BIOCHEMIST: Ph.D. Trained in protein chemistry, for research institute work on isolation of regulators concerned with the mechanism of hematopoiesis. Address inquiries to: Director, Toledo Hospital Institute of Medical Research, 2805 Oatis Avenue, Toledo 6, Ohio.

PSYCHIATRIST: Board certified or Board eligible, to act as a consultant to state mental health clinics, plan education programs for clinic personnel, to assist communities in organizing mental health clinics, to teach medical students and psychiatric residents concerning the field of community mental health, and to organize and participate in research on problems in community mental health. Interest in child psychiatry desirable. Position carries a professorial appointment in the medical school. Rank and salary according to qualifications. Address: Paul E. Huston, M.D., Chairman, Department of Psychiatry, College of Medicine, State University of Iowa, Iowa City, Iowa.

PEDIATRICIAN: Full-time teaching and research. Interested candidates please send complete curriculum vitae and recent photograph to Dr. J. M. Severens, Creighton University School of Medicine, Omaha 2, Nebr.

ASSISTANT PROFESSOR OF ANATOMY: Ph.D. or M.D. State medical school, Southwest. Opening for histologist-embryologist with research interests. Ample time and facilities for investigative work. Salary dependent on past record. Address: V-81.

PSYCHIATRIC SOCIAL WORKER: Full time appointment as assistant professor of psychiatric social work in department of psychiatry. Duties will include some administrative responsibility, supervision and teaching in the undergraduate program of the medical school and in the residency training program. Salary, $7500 per annum. Interested applicants should send curriculum vitae and a recent photograph to Mrs. Imogene S. Young, Director, Psychiatric Social Work Services, University of Maryland Medical School, Baltimore 1, Maryland.

DIRECTOR OF INTERN EDUCATION: Physician director of Intern Education needed for 300-bed hospital. Salary $10,000 per annum, plus extra stipend for research fellowship. Write Dalton M. Welty, M.D., Washington County Hospital, Hagerstown, Md.

VIROLOGIST: Positions available for two individuals with B.S. or M.S. degrees with background in virology. Positions are in a research laboratory associated with a medical school. Address: V-82.

IMMUNOLOGIST-IMMUNOCHEMIST: Position as Research Associate is available for full-time investigations in the field of thyroid immunology and protein chemistry. Ph.D. or M.D. with training in protein manipulations and/or immunologic procedures. Salary $6,000 to $8,000, depending on background. Interested candidates should send a complete curriculum vitae and recent photograph to Dr. Sidney Shulman, Department of Bacteriology and Immunology, University of Buffalo School of Medicine, Buffalo 14, N.Y.

PSYCHIATRIST: Assistant or associate professor of psychiatry required. This position will be that of geographical consultant with a salary and rank according to experience and qualifications (within the range of $7,700 to $10,200) and private consulting privileges. Applications to R. Bruce Sloane, M.D., Department of Psychiatry, Queen's University, Kingston, Ontario.

CHILD PSYCHIATRIST: Assistant or associate professor in child psychiatry required. This position will be that of geographical consultant with a salary (within the range $7,700 to $10,200) according to experience and qualifications, and private consulting privileges. Applications to R. Bruce Sloane, M.D., Department of Psychiatry, Queen's University, Kingston, Ontario.

PSYCHIATRIST: Lecturer in psychiatry required. Salary (within range of $6,000 to $8,000) and consulting privileges, according to experience and qualifications. Applications to R. Bruce Sloane, M.D., Department of Psychiatry, Queen's University, Kingston, Ontario.

HEMATOLOGY: M.D. (young) to do research in modern diagnostic methods in hematology and allied diseases in collaboration with medical and engineering groups. Address: V-83.

MEDICAL DIRECTOR: Coordinator of medical education for a 300-bed major teaching hospital of a New England medical school. Academic appointment dependent upon qualifications. Consultation practice or research possible. Address: V-84.

PSYCHIATRIST: Board certified with university and state hospital experience to serve as supervisor of psychiatric residents for newly approved three-year program with time divided equally between University of Washington and Northern State Hospital. Position will carry faculty rank at the medical school and residence in Seattle is feasible. Present staff at Northern State Hospital is currently expanding from 25 full-time positions to an authorized strength of 35 positions for 1670 patients. Salary $14,220–$16,836. Address: Charles H. Jones, M.D., Box 309, Sedro Woolley, Washington.

To aid in solution of the problem of faculty vacancies, MEDICAL EDUCATION will list persons and positions available, as a free service. The school department or person may have the option of being identified in these columns or of being assigned a key number for each position listed. Mail addressed to key numbers will be forwarded to the person or department listing the request.

Information for these columns should reach the Personnel Exchange, Journal of Medical Education, 2530 Ridge Avenue, Evanston, Illinois, not later than the 10th of the month which precedes the month in which the listings will appear.

Personnel Available

VETERINARIAN: Experienced in microbiological techniques; presently at a medical school. Desires position as director of experimental animal laboratory. Address: A-404.

MICROBIOLOGIST-VIROLOGIST: Ph.D., presently on university faculty. Five years experience in virology and tissue culture publications. Desires academic position involving full-time research or research and teaching. Address: A-405.

ORTHOPAEDIC SURGEON: 38. Wants appointment in U.S.A. or Canada. Main interest in Traumatic Surgery and Research. Now holding consultant post at well known British Hospital. Mastership in Surgery and Fellow of the Royal College of Surgeons. Address: A-406.

PSYCHIATRIST-NEUROPHYSIOLOGIST: M.D. Certified in psychiatry and as a mental hospital administrator. FAPA and FSPA. No formal training in neurophysiology but using some of its principles with gratifying results in coping with the manifold problems of psychosomatic medicine. Desires full-time career teaching position in medical school with opportunities for teaching psychiatry; for learning clinical neurophysiology well enough to instruct; and for carrying on more intensive course of clinical investigation. Address: A-407.

PHYSIOLOGIST: Ph.D., 1957, age 31, married, one child. Research in cardiovascular-renal physiology. Strong background in hypertension. Eleven publications. Experience in teaching medical, dental, and pharmacy students. Desires research position with or without teaching responsibilities. Address: A-408.

MICROBIOLOGIST: Ph.D., Sept., 1959. Training in all fields of basic microbiology with research in microbial metabolism. Desires faculty position with teaching and research opportunities in a university or medical school. Address: A-409.

PHYSIOLOGIST-ENDOCRINOLOGIST: Ph.D., age 36. Training and background in endocrine, cellular, mammalian and zoological physiology. Presently assistant professor engaged in teaching and research in endocrinology and general physiology. Formerly research associate in biochemistry. Desires academic and/or research position. Address: A-410.

ANATOMIST: Age 34, married. Ph.D. Anatomy 1957. Publications. Teaching experience in Eastern medical school. Desires teaching position with opportunity for research. Address: A-411.

INTERNIST: Age 35, married. Ten years training in internal medicine and hematology. Teaching experience and research in field of clinical hematology, B_{12} metabolism, radioactive uptakes, experimental hematology, and enzyme studies. Desires teaching position with opportunity for research. Address: A-412.

SURGEON: Age 35, native of Bombay, India. In U.S. since 1952. F.C.P.S. (Bombay). F.R.C.S.E. (Edinburgh). Completed residency training in general surgery in U.S. and successfully taken Part I examination of American Board of Surgery. Desires full-time position in teaching and/or research in American medical school. Presently senior resident in surgery in Eastern hospital. Experience in plastic surgery as well as urology and anesthesiology. Address: A-413.

UROLOGIST: University trained, finished 1956. Seeking full-time academic post: teaching, research, and clinical work. Presently in private practice and part-time university teaching. Address: A-414.

GROSS ANATOMIST: D.S.D., Ph.D. Ten years teaching experience in medical school; previously taught in dental school. Clinical experience in plastic and oral surgery. Research interests and publications: homotransplantation of tissues. Desires academic position in medical or dental school with research facilities. Will consider research associateship with plastic surgery department. Address: A-415.

MICROBIOLOGIST: Ph.D. Seeking position on medical school faculty in Southeast or Southwest. Many years experience and supervision in clinical microbiology. Six years on medical school faculty. Qualified in parasitology, virology and public health. Address: A-416.

SURGEON: Age 33. Certified in surgery and thoracic surgery. University trained with research background. Presently holding part-time university teaching appointment. Desires full-time academic appointment in surgery, preferably with additional duties as assistant dean working with curriculum and postgraduate training program. Address: A-418.

INTERNIST-GASTROENTEROLOGIST: Age 42. Board certified in internal medicine and in gastroenterology. Training and experience include 4 years as Mayo Foundation Fellow, full-time instructor in gastroenterology in leading university, clinical investigation and private practice. Trained in all gastroenterological techniques and bone marrow interpretation. Qualified in hematology, peripheral vascular diseases and rheumatology. Desires academic position in internal medicine, gastroenterology, comprehensive medical care section, as Assistant Dean, or as Director of Medical Education in teaching hospital. Address: A-419.

MICROBIOLOGIST-CLINICAL PATHOLOGIST: M.D., Ph.D., age 54, married. Wide experience in teaching and research in the United States. Returning after several years of teaching in medical schools in the Far and Middle East. Textbook in course of publication. Desires research or teaching position in medical school or in teaching hospital. Address: A-420.

PATHOLOGIST-VIROLOGIST: DVM, Ph.D. Experience in comparative pathology, virology and tissue culture techniques. Also considerable experience in teaching experimental pathology to medical students. Desires teaching appointment in a medical school that would provide opportunity for completion of courses leading to M.D. degree. Address: A-421.

PSYCHIATRIST: Board certified, with training in both general clinical psychiatry and public health psychiatry (M.P.H. degree). Six years' experience in administering a community-oriented psychiatric training program in an academic setting. Broad range of personal service in teaching, supervisory, and consultative capacities. Dynamic orientation. Numerous research publications. Age under 40. Currently assistant professor at medical school. Desires full-time faculty appointment at higher level. Address: A-422.

PSYCHIATRIST: Board certified in psychiatry and child psychiatry (pending). Eight years experience in teaching at student and resident level in adult and child psychiatry in academic setting. Broadly experienced in teaching, supervisory, and consultative capacities. Analytic orientation. Nine publications. Experience in administering child guidance clinic and in community aspects of psychiatry. Has held position as associate professor of psychiatry; wishes to head up division of child psychiatry in medical school in either true or geographic full-time position. Metropolitan area preferred. Age 45; married; 4 children. Address: A-423.

PHYSIOLOGIST-PHARMACOLOGIST: M.D., Ph.D., age 40. Teaching and research experience includes six years in pharmacology and six years in physiology, with one year training in laboratory of high polymer chemistry. Desires academic and research position in physiology or pharmacology department. Address: A-424.

INTERNIST: Board certified, university trained, with one year training in clinical cardiology and one year in cardiovascular laboratory. Presently holding position as university instructor. Desires faculty appointment with teaching and research in clinical cardiology and electrocardiography. Address: A-425.

ANATOMIST: Ten years teaching experience; all phases of medical school anatomy. Broad research interests with grant support in gross anatomy and histology. Desires university appointment. Northeast or northwest preferred. Address: A-426.

ZOOLOGIST: Ph.D., age 43, married, family. Desires teaching microanatomy in medical school. Experience: medical school teaching (medical parasitology); USPHS senior assistant scientist, foreign experience as malariologist; undergraduate teaching, including 6 years instruc ing pre-medical students in histology. Publications, active research program; current interest: histochemistry techniques in study of cellular basis of resistance to a parasitic infection. Willing also to instruct in parasitology, if situation permits. Available with one semester notice to present employer. Address: A-427.

ANATOMIST: M.B., Ch.B. (Witwatersrand, Johannesburg, South Africa), F.R.C.S. (Edinburgh). Age 52, desires position in medical school as senior lecturer in anatomy. Presently located at University of The Witwatersrand as official lecturer in anatomy; part-time senior lecturer in gross and applied anatomy since 1949. Publications. Surgeon to Union Defence Forces, 1940–46 with rank of major. In private practice as a general surgeon since 1946. Address: A-428.

PEDIATRICIAN: Age 40, married, 3 children, 7 years in general practice, 5 years in academic pediatrics as assistant professor. Emphasis on clinical teaching, growth and development research, and the handicapped child. Seeks relocation at associate professor level. Excellent references. Available in summer of 1960. Address: A-429.

PHARMACOLOGIST-CLINICAL: M.D., Ph.D., age 33, licensed physician. Publications, academic and industrial experience, some psychiatric training. Desires teaching position. Address: A-430.

HUMAN GENETICIST: Ph.D., age 36, seven years experience at leading human genetics center, including heredity clinic service, population surveys of hereditary traits, and statistical analyses. Fourteen publications. Desires permanent university position, preferably research and teaching. Address: A-431.

PHYSICAL BIOCHEMIST: Ph.D., Assistant Professor of Biochemistry in an Eastern medical school. Research and publications. Physical chemistry of proteins. Energetics, kinetics, and mechanism of enzymatic reactions. Protein interaction with ions and steroids. Isolation and identification of steroids. Osmometry and potentiometric studies of polyampholytes. Desires appointment with medical school or research institute. Address: A-432.

CERTIFIED INTERNIST: Age 38, experienced in diabetes, endocrinology, radioisotopes (licensed by AEC). Several years direction of medical residency training program, and radioisotope unit in large teaching hospital, and Assistant Professor of Medicine in charge of student diabetes clinics. Now in private practice. Desires return to full-time teaching hospital and/or medical school. Address: A-433.

GROSS ANATOMIST: Ph.D. Eight years teaching experience; desires academic position in medical or dental school. Available summer 1960. Address: A-434.

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PUBLICATIONS

Useful information for both medical educators and students is published by the Association of American Medical Colleges. These publications may be obtained from the Association headquarters office, 2530 Ridge Avenue, Evanston, Ill.

Books and Pamphlets

Admission Requirements of American Medical Colleges—1958–59 ($2.00).

History of the Association of American Medical Colleges—1876–1956

The National Health Service of Great Britain ($1.00).

El Estudiante de Medicina ($1.00)

Suggestions for Supplementing the Medical Curriculum in Time of National Emergency

A Study of Medical College Costs ($1.50)

The Journal of MEDICAL EDUCATION

A monthly journal devoted exclusively to medical education.
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Journal supplements available:

Education of Physicians for Industry ($2.00).
Support of Research by American Cancer Society ($1.00).
Survey of Women Physicians graduating from Medical School 1925–40 ($1.00).
Medical Education for Foreign Scholars in the Medical Sciences ($1.50).

Teaching Institute Reports ($2.00 paperbound, $3.00 clothbound).

Report of the Conference on Preventive Medicine in Medical Schools (Report of the 1952 Institute).

The Teaching of Physiology, Biochemistry and Pharmacology (Report of the 1953 Institute).

The Teaching of Pathology, Microbiology, Immunology and Genetics (Report of the 1954 Institute).

The Teaching of Anatomy and Anthropology in Medical Education (Report of the 1955 Teaching Institute).

The Appraisal of Applicants to Medical School (Report of the 1956 Institute).

The Ecology of the Medical Student (Report of the 1957 Institute).

Report of the First Institute on Clinical Teaching (Report of the 1958 Institute).

Medical Audio-Visual Institute Publications

Film Catalog, Fall 1955 and Supplements.

Films in Psychiatry, Psychology and Mental Health (available from the Health Education Council, 92 Belmont Drive, Livingston, N.J.).

Films in the Cardiovascular Diseases (Part I available from the American Heart Assn.), 44 E. 23rd St., New York 10, N.Y. ($2.00).
Part II available from the Medical A-V Institute ($2.00).

Publications of Related Organizations

Hospitals Participating in the Matching Program 1959 (NIMP).

Results of the Matching Program 1959 (NIMP publication).

The Student and the Matching Program 1959 (NIMP publication).

Medical College Admission Test—Bulletin of Information 1959 (Educational Testing Service publication).

Psychiatry in Medical Education—1951 Conference ($1.00).

The Psychiatrist: His Teaching and Development—1952 Conference ($2.50).

(The above can be obtained from: American Psychiatric Assn., 1785 Massachusetts Avenue, NW, Washington, D.C.).

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1. Macy, I. G.; Kelly, H. J., and Sloan, R. E.; with the Consultation of the Committee on Maternal and Child Feeding of the Food and Nutrition Board, National Research Council: The Composition of Milks, National Academy of Sciences, National Research Council, Publication 254, Revised 1953. 2. Research Laboratories, Mead Johnson & Company.

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